

A HISTORICAL REVIEW OF THE
MOLLUSKS OF LINNAEUS

PART 4. THE GENERA *BUCCINUM* AND
STROMBUS OF THE CLASS GASTROPODA

HENRY DODGE

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COLLATERAL NOTES

IN THE COURSE OF THE preparation of the present series of papers, certain historical, bibliographic, and taxonomic questions have arisen which, while outside the narrow scope of the work itself, are sufficiently germane to its general subject to seem to justify comment. Instead of using the inappropriate heading "Foreword," as in earlier parts, I shall henceforth group my discussion of these questions under the heading "Collateral Notes," as they are in no sense forewords to the discussion of the particular species treated in the main text.

1. Statements made in Part 3 of the present series, in the discussion of *Voluta monilis*, *V. mercatoria*, *V. paupercula*, and *V. sanguisuga*, must be corrected. I correctly stated that none of these species was described in the "Museum Ulricaë," but my further statements that no specimen of any of them is found today in the Queen's collection at Uppsala were erroneous. In the case of *V. monilis*, Dr. Holm of the University of Uppsala has recently found in the collection a string of 29 bored specimens. This is, incidentally, a further confirmation of the ornamental use of the shell and of the source of the specific name. In the opinion of Dr. Odhner (personal communication, 1955) these specimens were probably added after the publication of the "Museum Ulricaë" in 1764. Specimens of the other three species mentioned have also turned up in the collection, and Dr. Odhner suggests that these also represent later additions.

It seems most improbable that Linnaeus would have omitted the descriptions of these species if the specimens had been present when he catalogued the collection. Dr. Odhner adds, "... they may have been duplicates in Linné's own collection used by him for exchange against fine examples from the Queen's collection." Not only does it seem improbable that Linnaeus would have been guilty of such a substitution but, as farther evidence that they were added by some person other than him, Lovén (1887, p. 44) states that as late as June, 1770, Linnaeus was summoned to the Queen's residence at Drottningholm "to put in order the new acquisitions."

2. In Part 3 of the present series (Dodge, 1955, pp. 41-45) the species *Bulla terebellum* Linné, 1767 (*Conus terebellum*, Linné, 1758), was discussed, with particular emphasis on the confusing subdescription that Linnaeus supplied under the name *Bulla terebellum* in the "Museum Ulricaë." Since the publication of that part, Dr. Nils Odhner of the Naturhistoriska Riksmuseet in Stockholm has suggested (personal communication, 1955) a possible partial explanation of Linnaeus' confusion. The pertinent excerpt from Dr. Odhner's letter follows: "As to *Conus terebellum* I have been in the same predicament as yourself, and wondered whether Linné had made some confusion when writing his diagnosis in M.L.U. I think that he might have had before him both *terebellum* and *Conus nussatella*, which he had both described already in 1758 (perhaps they were even then united in a single number). Afterwards he observed his mistake and corrected it in 1767, keeping *C. terebellum* (= *C. nusatella* in his own collection), but separating the second *terebellum* into *Bulla*. In 1764 he found this separation necessary because of the differences between diagnoses of the two, but did not fulfill his intention perfectly—or did it later on *in the collection* with the aid of his Syst. Nat. 10" (italics mine).

3. There has been an apparent misunderstanding as to the author to whom the molluscan names in the Portland Catalogue (1786) should be attributed. Many of these names were, in fact, first given to the shells by Daniel Solander, but were never published, being used only in his manuscript "species slips" designed to be eventually incorporated in a "General survey of natural history," in the words of Iredale (1916), which was to be, in effect, a revision of Linnaeus' "Systema naturae,"¹ or on manuscript labels

¹ The so-called "Solander manuscripts" so often referred to in the early literature consisted of the several volumes of these species slips. They were originally contained in the library of Sir Joseph Banks but were later acquired by the British Museum (Natural History), where they are still preserved. They were extensively studied and referred to by many of the early conchologists, including George Humphrey, Richard Pulteney, William Maton, and his collaborator, the Rev. Thomas Rackett, George Montagu, L. W. Dillwyn, Edward

furnished by him for the collections of Banks and Sir Hans Sloane and, possibly, for the collection of the Duchess of Portland which was sold at auction in 1786. Both of the two first-named collections are now in the British Museum (Natural History).

The first use of these names in a published work was in the Portland Catalogue. This was published anonymously, but we have the authority of Dillwyn (1817, p. 177, and 1823, p. 5) that the compiler of the Catalogue was, in fact, George Humphrey. The work contained many of the original Solander names as well as many others erected by Humphrey himself. Although the names copied by Humphrey from Solander's manuscript slips or labels are often attributed to Solander in recent molluscan literature, it is inescapable that they, as well as the new Humphrey names in the Catalogue, should be cited as of Humphrey alone.¹

Some of the names in the Portland Catalogue are followed by the letter "S," indicating, we assume, that they were copied from the Solander manuscripts or labels.

Donovan, W. J. Broderip, Sylvanus Hanley, and others. More recently the history of these manuscripts is discussed in detail by Wilkins (1955, pp. 81-86). That Banks was originally the custodian of the manuscripts is recorded by Dillwyn in his bibliography to the "Descriptive catalogue of recent shells" (1817, p. xi) as follows, "Solander's MSS. Manuscript descriptions of Shells, by the late Dr. Solander, in the Library of the Right Hon. Sir Joseph Banks."

Some recent writers have cited such names as " 'Solander' Humphrey," and the present writer has been guilty of this unnecessary and unwieldy, although possibly permissible, usage.

4. The evidence available to the present writer indicates that the "Index rerum naturalium Musei Caesarei Vindobonensis" of Born, which bears the date "1778" on its title page, was not published until 1780, and this conclusion is noted in the Bibliography below.

Since the preparation of my bibliographic note, R. F. Rutch, of the University of Berne, has noted (1956) that the "Index" was actually published at least as early as 1779, as is indicated by a manuscript note by J. S. Wittenbach in the copy of the work owned by the University to the effect that "he received the copy in 1779." Further, Rutch refers to the fact that Fr. Brauer (1878) cites the publication of the "Index" as of 1778. Rutch adds, "We have therefore no reason to doubt that Born's 'Index' was really published in 1778." Brauer, in his paper, supplies no evidence that the "Index" was published in 1778, other than his citation of it as of that year.

¹ See Rehder (*in* Rogers, 1951) who cites many of the "Solander" names as of Humphrey, and Wilkins (1955, p. 88) who says of the Catalogue, "As . . . the compiler was, in fact, George Humphrey, the latter may be regarded as the first publisher of the names used therein, whether Solander's or his own."

CLASS GASTROPODA

BUCCINUM LINNÉ

THE *Buccinum* OF THE tenth edition of the "Systema naturae" contained 47 species. In the twelfth edition two species were moved to other genera (*B. virgineum* to *Bulla* and *B. scabriculum* to *Voluta*), and six new species were added: *haemastoma*, *bezoar*, *glaciale*, *subulatum*, *vittatum*, and *lanceatum*, making a total of 51 species. Five more were added in the "Mantissa," 1771.

All have been satisfactorily identified except three of the "Mantissa" species (*gemicum*, *monile*, and *proximatum*) and one "Systema" species (*murinum*). Tryon (1879–1888, vol. 7, p. 39) tentatively, and probably correctly, placed them in the genus *Terebra* Bruguière, 1789, but listed them as *species dubiae*.

As will be seen in the following pages, this is another extremely heterogeneous group. It was drastically broken up at a comparatively early date, the most important genera carved out of it being erected prior to 1800: *Harpa* Walch, 1771, *Tonna* Brünnich, 1771, *Cassis* Scopoli, 1777, *Purpura* and *Terebra* Bruguière, 1789, *Thais* and *Cantharus* Röding, 1798. In all, the Linnaean species of *Buccinum* are now included in 20 different genera, many of them remote from one another both biologically and in shell characters, such as *Cassis*, *Terebra*, and *Nassarius*, to mention but three. Only two species remain in *Buccinum* as at present restricted, *B. glaciale* and *undatum*.

The Linnaean genus is, however, remarkable in the fact that the author's concept of the individual species was so clearly fixed in his mind in 1758 that the lack of material change in 1767 is very noticeable. In the case of the great majority of the species the descriptions suffered no change, and in several others the only changes were in grammar and punctuation. The few alterations that may be called material are discussed under the respective species, below.

THE TUN SHELLS OF *Buccinum* LINNÉ

The first step in the dismemberment of *Buccinum* Linné was the erection by Brünnich of the genus *Tonna* in his "Zoologiae fundamenta" (1771, p. 248). While the author described no species, the generic definition

was adequate to cover the species later ascribed to it, including the five Linnaean species *olearium*, *galea*, *perdix*, *pomum*, and *dolium*.¹

The Linnaean species, with the exception of *pomum*, form a compact group distinguished by lightness of shell, generally large size, and absence of teeth on the outer lip, which, however, is often crenulated by the terminations of the spiral cords, a feature present in all members of the genus *Tonna*. The fifth species (*pomum*) is much smaller, heavier and more solid, and is provided with "teeth" in the form of pronounced parallel ridges which commence just inside the lip edge.

The next name proposed for the whole group was *Cadus* Röding (1798, p. 151),² followed by *Cadium* Link (1807, p. 113), both genera including *pomum* as well as the thinner-shelled species. *Buccinum perdix* Linné, 1758, is the type species of both *Cadus* and *Cadium*, by subsequent designation, Woodring, 1928. It was not until 1832 that the *pomum* group was separated from *Tonna*. In that year Valenciennes (1832, p. 325) erected the genus *Malea*, based on a shell found on

¹ Winckworth (1945a) placed the *Tonna* problem before the International Commission on Zoological Nomenclature in an application to have *Tonna* Brünnich added to the Official List of Generic Names in Zoology. The Commission (Hemming, 1950, p. 310) acted on the application and agreed to place the name on the Official List, with *Buccinum galea* Linné, 1758, as type species, as designated by Suter, 1913. In the course of the discussion evidence was adduced that the "Zoologiae fundamenta" was first published in 1771 and not in 1772 as had been supposed. The Commission, in its decision, included a validation of the 1771 date. A recent Opinion, number 237, dated May 21, 1934, implements this decision and a further Opinion of the same date, number 236, accepts the Brünnich work for nomenclatorial purposes.

² Prior to the erection of Röding's *Cadus* the author of the names in the "Museum Calonnianum" (1797) had used for this group the name *Dolium*, which he had adopted from Browne's "Natural history of Jamaica" (first edition, 1756). Not only was this edition of Browne, in which *Dolium* first appeared, pre-Linnaean, but Browne was a polynomial writer. The "Museum Calonnianum" is not accepted for any nomenclatorial purpose by the terms of Opinion 51 of the International Commission on Zoological Nomenclature. It was not until four years later that Lamarck, 1801, validly used the name *Dolium*.

the coast of Chile, which he called *latilabris*, which is *Cassis ringens* Wood, 1828. Its type species is *M. latilabris* Valenciennes, 1832, by subsequent designation, Gray, 1847, and Herrmannsen, 1847. In the meantime Lamarck had published his genus *Dolium*, 1801, with a single "example," *D. galea* (Linné), and in his first definitive list of species (1822, vol. 7, pp. 259–262) seven species were listed, including all the Linnaean names, if we agree that his *D. maculatum* is Linnaeus' *dolium* and that he changed this name to avoid a tautonymic designation. *Dolium* Lamarck was used generally until the comparatively recent rediscovery of *Tonna* Brünnich, to which Dall called attention in 1906 (p. 296) and in 1909 (p. 72). *Malea* is still used by most writers for species of the *pomum* group, although *Quimalea* Iredale, 1929, has to some extent supplanted it for *pomum* (see discussion of *pomum*, below).

In addition to *Cadus*, *Cadium*, and *Dolium*, the following are synonyms of *Tonna*: *Perdix* Montfort, 1810, not Brisson, 1760, type species *P. reticulatus* Montfort, by original designation; *Foratidolium* Rovereto, 1899, a new name for *Perdix* Montfort; and *Parvitonna* Iredale, 1931, type species *P. perselecta* Iredale, by monotypy. Forbes, 1852, erected the genus *Macgillivraya* for some small pelagic mollusks, which were demonstrably the young of some *Tonna* species, although not specifically determinable. Fischer assigned them to *Tonna perdix*.

The name *Tonna*, from which the Anglicized vernacular name "Tun" was derived, was used as "Tonne" by Gersaint, 1736, Argenville, 1742, Knorr, 1771, Seba, 1758, and Davila, 1767, and Lamarck used "Tonne" as the French vernacular name for his *Dolium*.

All species of *Tonna*, and some species of *Quimalea*, are very variable, not only in size, but in color, color pattern, sculpture, and shape. This has often made it difficult to allocate a given form or individual to any one valid species, with the result that a host of useless synonyms have been proposed. Winckworth and Tomlin's list of the Tonnidae (1933, pp. 206–213) contains 96 names, fewer than one-third of which are listed in capital letters, signifying good species. The Tonnidae have a wide range, the species being found in the western Atlantic, through-

out the Indo-Pacific region, and on the west coast of Africa.

In addition to the variability of the individual species, the Linnaean descriptions of this group are brief and unrewarding and omit many of the important diagnostic features of the shells. The synonymies, too, are unsatisfactory, as many of them cover two or more species. It is one of the worst-defined groups in the "Systema naturae." By the time that the descriptions have been compared one with another and the purging of the synonymies has been attempted, and, in two cases, after the apparently incorrect numbering of specimens in the Linnaean collection has been considered, we are left with the suspicion that Linnaeus' own concept of the group was confused. Much ink has been expended on the conflicts in the identifications of these names by Linnaeus' successors, and the present writer confesses that he is not entirely convinced that, in every case, the shells that are today considered as the representatives of the Linnaean names are correctly identified.

Buccinum olearium

1758, Systema naturae, ed. 10, p. 734, no. 376.

1767, Systema naturae, ed. 12, p. 1196, no. 438.

LOCALITY: "In O. Indico" (1758, 1767).

"B. testa subrotunda cincta sulcis obtusis: lineola elevata interstinctis, apertura edentula."

The shell that was identified as *olearium* by the majority of writers for almost one hundred years and that is still called by that name by many workers and so labeled in many museums is a different species and one that does not conform to the Linnaean description. This *olearium* of authors is a globose shell with numerous very flat, strap-like, spiral ribs which are so closely set that the interstices appear to be merely incised lines. Its ribs are so low, particularly in the upper portion of the body whorl, that in worn specimens, and even occasionally in fresh ones, the upper third of the whorl appears almost smooth. Linnaeus' shell, on the other hand, was described as having "lineola elevata interstinctis," a phrase that refers to the spiral threads between the main ribs, one or more of which are present in many species of this group, either between all ribs or only those at the top of the whorl. Linnaeus would hardly have used the cited

phrase if it had not been applicable, and no such interstitial threads are found in the *olearium* of authors.

It was not until Hanley critically examined the Linnaean collection in London in the years immediately preceding 1855 that a reasonable suggestion as to the real identity of *olearium* Linné was advanced, although Green in 1830 and Philippi in 1851 had published figures of a shell which entirely conformed to Linnaeus' description. These figures and their descriptions are discussed below in their historical sequence.

The description of *olearium* Linné, which is identical in the tenth and twelfth editions of the "Systema," is much too brief to be satisfactory, as are all the descriptions of the Linnaean Tun shells. However, short as it is, it seems curious that the early writers and even many authors of more recent times should not have given due weight to the phrase covering the interstitial threads. It is probable that the discordance of the synonymy was largely the cause of the confusion which resulted. Two of these references (Rumphius, pl. 27, fig. D, which Linnaeus himself listed with a question mark, and Gualtieri, pl. 44, fig. T) show the shell that is almost universally called *olearium* today. It is referred to here as the *olearium* of authors, as I am convinced it is not the shell that Linnaeus described. It has wide and flat spiral ribs with no elevated threads between them. The only other reference (Petiver, pl. 99, fig. 11) was said by Hanley (1855, p. 239) to show *Dolium fimbriatum* Sowerby, 1827. The latter species is closely allied to *Buccinum dolium* Linné, and is figured by Sowerby (1820, 1825-1834, vol. 2, pl. 242, fig. 2, an apertural view). On the same plate, however, is shown a dorsal view of the *olearium* of authors entitled *D. olearium*, and the latter figures resemble Petiver's figure very closely. It is evident that Hanley erroneously reversed the two titles on Sowerby's plate.¹

¹ Reeve (1843-1878, vol. 5, *Dolium*, pl. 8, sp. 15), in discussing his *Dolium deshayesi*, read the Sowerby plate correctly, as appears from the following quotation: "A comparison of this shell [*deshayesi*] with the Lamarckian *Dolium olearium* enables me to confirm the accuracy of Mr. Deshayes' observation (Anim. sans vert. vol. 10, p. 140) to the effect that the specimen figured for that species by Mr. Sowerby in his 'Genera of Shells,' and by myself, from the same engraving, in 'Con-

Linnaeus did not own a specimen of his *olearium*, at least at the date of the publication of his twelfth and last edition, as the name does not appear on either of his lists of owned species, and the description, therefore, must have been based on a borrowed specimen or on a description supplied by a colleague. Its identity is further clouded by the fact that the "Systema" number of *olearium*, 438, is written on a young specimen of *Buccinum galea*, the succeeding species, in his collection in London. This was probably a slip of the pen, as the species cannot be confused.²

In 1777, Martini (1769-1777, vol. 3, p. 401) described a *Dolium cepa*, attributing it to the *olearium* of Linnaeus, but citing, among other figures, the Rumphius figure of the *olearium* of authors cited in the "Systema." It is impossible to determine from his text just which *olearium* he is describing. His figures (*tom. cit.*, pl. 117, figs. 1076-1077) are also equivocal. They have the shape and major sculpture of the false *olearium*, but lines appear in the interspaces which may be merely the artist's method of representing shading.

The same interpretation was made by Schröter (1783-1786, vol. 1, p. 307, no figure). It is apparent that he was describing the *olearium* of authors. Bruguière (1789, 1792, p. 243) followed the same identification. Dillwyn (1817, p. 582) was the first to de-

chologica Systematica,' is distinct from it. . . . The figure in 'The Genera' gives a characteristic view of the back of the species."

² *Buccinum galea* has been confused with *olearium* by some writers, possibly because of the presence of interstitial threads in the upper part of the body whorl in young specimens. The shells are, however, quite distinct. In addition to the erroneously marked specimen, two other specimens of *galea* are in the Linnaean collection, one an adult and the other an immature shell. On the latter of these a further error is noticed. As reported by Hanley (1855, p. 239), this shell bears the number 339, the number for *Cypraea caput-serpentis*, instead of 439, its correct "Systema" number. These markings are not visible on the microfilm reproductions. As a further distinction between *galea* and *olearium*, the adult *galea* usually shows a twinning of the spiral ribs near their termination, which is most noticeable in the aperture. This fact alone should dispose of any temptation to unite the two species, as Linnaeus would surely have referred to it, as he did in his description of *galea*, had it occurred in *olearium*. Whatever may be the opinion of conchologists as to the identity of *olearium* Linné, it is surely not *galea*.

scribe the *olearium* of Linnaeus unequivocally. Although he cited most of the figures and listings of the *olearium* of authors that had been referred to by his predecessors, his description, "Shell roundish, transversely ribbed, with an elevated line in the interstices; aperture without teeth," is an almost exact translation of the description of Linnaeus. His subdescription also mentions the interstitial elevated lines and is so complete in its description of shape, color pattern, sculpture, and other details that it seems certain that he had seen a specimen, although his synonymy is merely a copy of the erroneous synonymies of his predecessors.

Lamarck (1822, vol. 7, p. 259) cited all three figures used by Linnaeus and added others, including the Martini figure mentioned above, which is probably the *olearium* of authors, the Bruguière listing, and a figure from the "Tableau encyclopédique" (pl. 403, fig. 1), which is unquestionably the *olearium* of authors. His description, too, mentions the flat, broad ribs separated by an impressed sulcus and again significantly omits a reference to interstitial threads.

Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 140) copied Lamarck's description. They said in a footnote: "Mr. Sowerby, in his *Genera of Shells*, and Mr. Reeve after him, in his *Conchologica Systematica*, showed under the name *olearium* a shell which appears distinct; the *olearium* always has a canaliculate suture; this feature is lacking completely, in Mr. Sowerby's figure." The figure referred to is the figure (1820, 1825-1834, vol. 2, pl. 242, fig. 2) mentioned above in connection with Hanley's misreading of this plate.

Seven years after the publication of the "Conchologica systematica," Reeve's "Conchologica iconica" (1843-1878, vol. 5, *Dolium*, pl. 8, sp. 14) definitely described the *olearium* of Bruguière and Lamarck, and omitted the *olearium* of Linnaeus as a good species. Reeve said: "This is the *olearium* of Bruguière, but not of Linnaeus, which accounts for his remark in the *Encyclopédie méthodique*: 'I do not know what Linnaeus meant by the words *sulcis obtusis lineola elevata interstinctis* . . . since neither the ribs nor the grooves show any elevated lines.' The shell upon which Linnaeus founded his *Buccinum olearium*, preserved in the museum of the Linnaean

Society of London, proves to be nothing more than a very young specimen of *D. galea*, in the early growth of which species there is always a fine elevated line in the interstices of the upper whorls." Aside from the strange blindness of Bruguière when confronted with the clear words of Linnaeus and his complete disregard of them, two comments may be made on Reeve's remarks. First, he accepted the number written on the specimen of *galea* in the collection as authoritative, rather than, as I believe, a *lapsus calami*. Second, the elevated threads in *galea* are not confined to the "upper whorls," or spire, alone, but are seen between the first few ribs of the body whorl, and, moreover, this feature is seen in both the immature and adult shell. In spite of these weaknesses the above quotation is the first categorical statement in the literature that *olearium* Bruguière is not *olearium* Linné. He ventured no opinion as to what Linnaeus' shell might be.

Hanley, in his more careful and critical study of the Linnaean collection, not only came to a different conclusion as to the *olearium-galea* complication but made the first identification of the *olearium* of Linnaeus, although this identification was only tentative. His words on this point are quoted in full (1855, p. 239): "Bruguière, who animadverted upon this discrepancy, nevertheless yielded to that traditional recognition by Schröter, etc., which was based on figures only; and the majority of writers have followed in his wake. Crouch, however, in his 'Introduction to Lamarck's Conchology,' has figured a shell (*Dolium zonatum* of Green [1830], Albany Instit. vol. 1, pl. 4; *D. crenulatum* of Philippi, Abbild. Conch) that precisely answers to both the description and the locality of the Linnean shell. As no engraving of it was extant at the time of our author's publication, it is not surprising that his synonymy was erroneous. A superb example of it was found along with the larger Linnean shells, but it may be doubted whether it was not of subsequent introduction. Either, then, we must regard that shell as the pristine *olearium*, or entirely omit the name as a Linnean species."

The Green description and figure unquestionably exactly conform to the Linnaean description, and the Indo-Pacific

locality of *zonatum* is established. Although Green's paper was on the *Dolium* of the United States, he said that his specimen of *zonatum* "was brought from the Pacific by the Rev. C. S. Stewart, chaplain in the U. S. Navy and late missionary to the Sandwich Islands." The Philippi figure is even more characteristic and more carefully drawn (1851, *Dolium*, pl. 1, fig. 1). Both figures plainly show the interstitial threads.¹

The Crouch figure (1827, pl. 19, fig. 2), however, cited by Hanley with so much assurance, has much less evidential value, even though Crouch called it "*D. olearium* (*Buccinum olearium*.—Linn.)." It shows a shell of the same general shape as that figured by Green and Philippi, but the principal ribs are much too narrow and there is only a single thread in all the intercostal spaces instead of two or three between the upper ribs and one between the remaining ribs as in *zonatum*. I should not be willing to base an affinity with *olearium* Linné on this figure, which I am unable to identify.

Again referring to *galea* Linné it should be noted that there the interstitial threads cease entirely in the lower part of the body whorl. Reeve (*tom. cit.*, *Dolium*, pl. 7, sp. 12) said of *zonatum* Green: "This is the only species of the genus in which there is an isolated raised line in the interstices of the lower ribs of the shell; the *D. galea* has an elevated line between the upper ribs in an early stage of growth, but in this portion of the shell in *D. zonatum* there are three." Reeve also synonymized *crenulatum* Philippi with *zonatum*.

The presence of a specimen of Green's *zonatum* in the Linnaean collection, which Hanley said was possibly "of subsequent introduction," may have more evidential value than Hanley gave it. Although Linnaeus did not own a specimen of *olearium* at the date of the publication of his twelfth edition, as the name does not appear on either of his lists of owned species, it is not impossible that he acquired one later and added it to the collection and that this was the specimen of *zonatum* which Hanley first discovered.

The difference of opinion as to the identity

of *olearium* Linné is still reflected in the works of more modern writers. Tryon (1879–1888, vol. 7, p. 262, pl. 2, figs. 8–11) apparently accepted the *olearium* of authors only, as he listed it as of Bruguière, and his description and at least his figure 8 indicate that species. Figure 9, which he called "*var. cumingii*, Hanley" (1849), has more numerous and narrower ribs and the sculpture is interrupted by darker and lighter-colored bands, decorated thickly with narrow, longitudinal brown lines. I would not associate it with the *olearium* of Bruguière. His figure 10 is referred to as "*var. Deshayesii*, Reeve" (1849). Its interrupting bands are decorated with white spots, rather than longitudinal brown lines. This shell also seems to be distinct from any form of *olearium* Bruguière. Figure 11 is reminiscent of the Crouch figure referred to by Hanley. Reeve (*tom. cit.*, pl. 8, figs. 13 and 15) considered these "varieties" as good species and, in any case, distinct from *olearium*. The words "broadly ribbed" in Tryon's description are not in accordance with any of his figures except possibly figure 8, but do describe the *olearium* of authors.

The most recent catalogue of the species of this genus by Winckworth and Tomlin (1933) accepts Hanley's tentative suggestion as entirely credible. They list *olearium* as follows: "OLEARIUM, *Buccinum*, Linné, 1758, Syst., p. 734. This is *zonatum* Green and *crenulatum* Philippi; see Hanley, *Ipsa Lin. Conch.*, p. 239. Figures: Crouch, *Lamarck*, pl. 18 [*sic*; should be pl. 19], fig. 2; Philippi, *Abbild.*, vol. 2 [*sic*; should be vol. 3], pl. 1; Reeve, C. L. fig. 12."

I have already discussed and rejected (1955, p. 34) the theory that *Bulla canaliculata* Linné was merely the young of the *olearium* of authors. This theory is repeated in the next listing in Winckworth and Tomlin who also separate the *olearium* of authors from Linnaeus' shell: "*Olearium*, *Buccinum*, Bruguière, 1789, *Encyc. Meth.* p. 243. Not *olearium* Linné. = *canaliculata*."²

The present writer realizes that there is

¹ Philippi had already described his *crenulatum* in 1845 (1845, p. 148), so that the name should date from the earlier year.

² It is not entirely clear from the punctuation of this listing whether these authors identify *canaliculata* with *olearium* Linné or Bruguière, but in either case I dissent for reasons already expressed, principally because both are globose or subglobose in all stages of growth, and neither can be described as "cylindrica" as the description of *canaliculata* requires.

evidence on both sides of the question, as between treating *olearium* Linné as a *species dubia* or accepting the *zonatum* of Green as the true representative of the Linnaean name. The evidence in favor of *zonatum* is, however, much stronger and, to me, convincing. I therefore favor the placing of both *zonatum* and *crenulatum* Philippi in the synonymy of *olearium* Linné, which should be treated as a good and well-defined species. This necessitates the abandonment of *olearium* of Bruguière and authors as a preoccupied homonym which should receive a new name. I here select the name *Tonna planicostata*.

The Linnaean species is now included in the genus *Tonna* Brünnich, 1771. Figures have been referred to above.

It was not described in the "Museum Ulricae."

An examination of the microfilm of the London collection in the writer's possession entirely substantiates Hanley's 1855 report.

Buccinum galea

1758, *Systema naturae*, ed. 10, p. 734, no. 377.

1767, *Systema naturae*, ed. 12, p. 1197, no. 439.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa obovata inflata cincta sulcis antice geminatis, apertura edentula . . . Testa magnitudo saepe Capitis humani."

The description, which is identical in the tenth and twelfth editions, is the clearest and most informative of that of any of the Linnaean descriptions of this group of species. The word "inflata" was used only for this species and *B. perdix*. The present species is the most inflated. The word is slightly less applicable to *perdix*. The phrase "sulcis antice geminatis," when Linnaeus' usual error in reversing the meaning of "antice" and "postice" is corrected, is applicable, among the Linnaean Tun shells, only to this species, as the first few spiral ribs, especially when viewed from within the aperture, appear to be twinned. This apparent twinning is caused by the depression of the sides of the intercostal spaces. I have never seen a specimen with bifid ribs. Perhaps the most significant item in the description is the statement that the shell is often as large as the human head, as *galea* reaches a size far in excess of the other Linnaean species of the group, although

later named species, notably *melanostoma* Jay, 1839, may be equally large.¹

Of the two references in the synonymy, the Gualtieri figure (pl. 47, fig. A) is clearly *galea* and has been selected by Turner (1948, p. 174) as the type figure. The Buonanni figure (pt. 3, pl. 183) is less characteristic, although it was probably based on a specimen of *galea*.

The locality is correct, although too restricted, as *galea* is found not only in the Mediterranean and along the northwest African coast but in the Indo-Pacific region from Zanzibar to the Hawaiian Islands and in the subtropical portion of the western Atlantic from North Carolina to the northern coast of South America. This extremely far-reaching range, which makes the species one of the most widely distributed of all mollusks except for the world-wide pelagic forms, has resulted in surprisingly few synonyms or varietal names, as the shell is remarkably constant in characters. Turner says on this point (1948, p. 174): "Except in specimens from Brazil there appears to be no character upon which geographic races can be instituted." The Brazilian form referred to was named *Dolium antillarum* var. *braziliana* by Mörch (1877), not *Dolium perdix braziliana* (Mörch, 1877), and is treated by Turner as a good subspecies of *galea*. The only distinguishing feature of the subspecies is the depression of the spire, "which in adult specimens hardly extends above the upper margin of the aperture" (Turner, 1948, p. 176). The West Indian species and those from the Indo-Pacific cannot be distinguished. Certain Indo-Pacific forms, *ampullacea* Philippi, 1845, and *tenebrosa* Hanley, 1859, may eventually prove to be only subspecies of *galea*. Indeed Hanley (1859, p. 488) treated *tenebrosa* as a mere "variety." The present writer has not seen specimens labeled with these names. Turner also adds the Indo-Pacific *zonatum* Green, 1830, as a name that may stand only as a subspecies of *galea*, but *zonatum* seems clearly distinguishable from the present species not only because of its generally smaller size but because of its smaller number of ribs,

¹ Dall (1921b, p. 125), after stating that *galea* Linné is not the *galea* of the Portland Catalogue, suggested that the latter might be *melanostoma*.

which are 14 as against 19 to 21 in *galea*, and the presence of interstitial threads between all ribs rather than merely between those at the posterior end of the whorl. On this point Reeve said, in discussing *zonatum* (1843–1878, vol. 5, *Dolium*, pl. 7, sp. 2): "This is the only species of the genus in which there is an isolated raised line between the interstices of the lower ribs of the shell; the *D. galea* has an elevated line between the upper ribs in an earlier stage of growth, but in this portion of the shell in *D. zonatum* there are three." I have suggested, in comments on the preceding species, *B. olearium*, that *zonatum* is merely a new name for that species and, further, that it is not a synonym of *galea*.

Dolium antillarum Mörch, 1877, from the West Indies, and *D. tenue* Menke, 1830, from the Mediterranean, are exact synonyms of *galea*, the latter being based on a juvenile shell. De Gregorio's Mediterranean "varieties" *epidermata*, *spirintrorsum*, and *tardina* represent only slight individual variations from the typical *galea*.

The name has had a very uneventful nomenclatorial history, as its small number of synonyms indicates. The name was first proposed by Linnaeus and not borrowed from any of his predecessors.

The best figures are those in Turner's paper (1948, pls. 78–79). Of the earlier figures Reeve's are the most characteristic (*tom. cit.*, *Dolium*, pl. 1, sp. 1).

I have already noted under *B. olearium*, above, that Tryon listed *olearium* as of Bruguière only. In his discussion of *D. galea* (1877–1888, vol. 7, p. 261) he said: "It is also *Buccinum olearium* Lin., not Brug." This was based apparently on Linnaeus' error in marking the "Systema" number of *olearium* on a very young specimen of *galea* in his collection, a fact that Reeve considered as indicating that *galea* was, in truth, the *olearium* of Linnaeus, but which Hanley dismissed as a slip of the pen. I adhere to Hanley's opinion (see discussion of *olearium*, above).

The species is not described in the "Museum Ulricae."

It is now included in the genus *Tonna* Brünnich, 1771, of which it is the type species, by subsequent designation, Suter, 1913. It is also the "example" given by Lamarck for his

Dolium, 1801, and was selected as type species of *Dolium* by Montfort in 1810.

Buccinum perdix

1758, *Systema naturae*, ed. 10, p. 734, no. 378.

1767, *Systema naturae*, ed. 12, p. 1197, no. 440.

LOCALITY: "Ad Americam" (1758, 1767).

"B. testa ovata inflata subsulcata alboque undulata, apertura edentula."

The description of this species is identical in the tenth and twelfth editions, and the same synonymy was used in both except for the addition of the Adanson and Seba figures in the twelfth.

The description is sufficiently clear to define the species and to distinguish it from *B. galea*, which immediately precedes it. The phrases "antice geminata" for *galea* and "alboque undulata" for *perdix*, as well as the reference in the description of *galea* to the size of the shell, "magnitudine saepe capitis humani," as *perdix* never attains the size of the larger individuals of *galea*, are decisively diagnostic of the two species. There are, however, some distinctive differences between them, which were not mentioned by Linnaeus, namely, the markedly twisted columella of *galea*, which is abruptly terminated at its junction with the parietal wall, as contrasted with the almost flat columella of *perdix* and its gradual blending into the parietal wall, and the relatively long basal canal of *galea*. The most marked difference is, however, in the color pattern, which is faint and blotchy in *galea* and brilliant and symmetrically disposed on the spiral ribs in *perdix*.

The identification with the *perdix* of authors is confirmed by the majority of the figures cited in the synonymy.

The figure cited from Colonna (pl. 69, fig. 5) shows a *Harpa*. No figure of a *Tonna* is found in this work.

Buonanni's figure (pt. 3, pl. 191) shows what is probably *perdix*, although it is slenderer than the typical form and the color pattern is not entirely accurate.

The figure from Lister (pl. 899, fig. 19) has only eight spotted ribs, with an obsolescent thread in the interspaces. It more nearly resembles *dolium* than *perdix*, although it cannot be accepted for either. However, in the manuscript notes for the proposed

"revised twelfth edition" of the "Systema," Linnaeus substituted for this figure an accurate representation of *perdix* from Lister (pl. 984, fig. 43). The original citation probably represents a *lapsus calami* or an error of the printer.

Rumphius' figure (pl. 27, fig. D) and that from Gualtieri (pl. 51, fig. F) seem to be clearly *perdix*.

The figure from Argenville (1742, pl. 20, fig. A), although it is only a dorsal view, is probably *perdix*, as the color pattern more nearly resembles that shell than *maculosa* Dillwyn.

The remaining figures in Linnaeus' synonymy are discussed after the following comments on *maculosa*.

The locality, "ad Americam," supplied by Linnaeus, is incorrect, as *perdix* is an Indo-Pacific species. The shell of its western Atlantic congener, *maculosa* Dillwyn, 1817, is so close to *perdix* in many shell characters that most conchologists throughout the nineteenth century and until fairly recently have united them, and many unrevised collections still show specimens of *maculosa* labeled *perdix*, although Dillwyn, 1817, Mörch, 1852, Hanley, 1855, Winckworth and Tomlin, 1933, and Bayer, 1937, all pointed out the differences between the two forms. Most of these writers, however, continued to call them forms of one species. The question is, it is hoped, now finally settled by the most recent discussion of this complex by Ruth D. Turner (1948, pp. 169-173) to which the reader is referred. The differences there mentioned are: the color pattern of *maculosa* is cloudy and less clearly defined than the more brilliant and more regular pattern of dark brown, quadrangular or crescent-shaped spots on the ribs of *perdix*; it has a slightly less prominent spire, somewhat more convex whorls, and the junction between the columella and the parietal wall shows an even curve as compared with the slight angle at this point exhibited by *perdix*; the ribs of *maculosa* number 20-21, whereas in *perdix* there are 18-19 and they are narrower and more clearly defined by somewhat deeper interspaces, so that in the latter species it is the color pattern which defines the ribs rather than their own prominence.

The figure from Seba (pl. 68, fig. 16), which

was cited for *maculosa* by Dillwyn and which was in Linnaeus' synonymy of *perdix*, contrasted with the Gualtieri figure (pl. 51, fig. F) in Linnaeus' synonymy adequately discloses some of these differences.

Dillwyn's description for *maculosa*, "Shell rounder, and the spire more distinctly grooved," emphasizes only two less obvious differences. He did not, however, treat it as a good species, but only as a "variety" of *perdix*, citing Solander's original use of the name in the Portland Catalogue (1786, p. 136). His localities for *perdix* covered both species, "the coasts of America," "Amboy-na," and "China and the South Seas." The true range of *maculosa* is from southern Florida to Brazil and throughout the West Indies; that of *perdix* is from the east African coast to the Hawaiian Islands. Dillwyn also included the "coast of Sénégal" in his localities, on the authority of Adanson. Adanson listed and described (1857, p. 107) a shell which he called "Le Tesan" and figured it (pl. 7, fig. 5). The figure resembles *maculosa*. Fischer-Piette and others (1942, p. 206) found, in the retained collection of Adanson (see Introduction to *Voluta*, Dodge, 1955, p. 53) nine specimens of "*Dolium perdix*," three of which bear the handwriting of Adanson. They said (p. 207): "The presence of this species in the Indian and Pacific Ocean, in Central America, and in the Antilles, is well established. Winckworth and Tomlin mentioned West Africa in its range; Adanson is nevertheless the only author who has reported it from the coast of the continent of Africa; it seems astonishing that it should not have been collected since then, as it 'is cast up in great numbers during the high tides of April on the sandy shores of Mbaou and Rufisk.' But it has been reported from the Canaries (quite rarely) by Orbigny; it is thus probable that it will be rediscovered some day in Sénégal." Inasmuch as Fischer-Piette and his co-authors did not figure any of the specimens of "*Dolium perdix*" which were found in the collection, I am not able to say whether they were *perdix* or *maculosa*, although they were probably the latter and probably did come from Senegal, as Adanson's report seems convincing. Fischer-Piette and his co-authors did not refer to any differences in shell characters between individuals from the several regions.

Winckworth and Tomlin (1933, p. 211), mentioned such differences but say, "we prefer to regard them as geographical subspecies, which may be called *Tonna perdix* *perdix* and *Tonna perdix* *rufa*."¹

Reeve (1843-1878, vol. 5, *Dolium*, pl. 6, sp. 9) described the Indo-Pacific shell under *perdix*, and his figure shows that shell. He comments: "It is not often that in genera so limited in kind as the present, a species occurs with so wide a range of habitation as the *Dolium perdix*. Inhabiting both hemispheres, it differs in the ribs being more or less elevated, but in no feature, sufficiently, to allow of its being made the subject of another species, as introduced by Dr. Jacob Green in the Transactions of the Albany Institute." Green's species was the *Dolium plumatum* (Green, 1830, p. 132), a name now recognized as being equal to *perdix* Linné.

Tyron (1879-1888, vol. 7, p. 264) also failed to separate the two forms specifically and did not list *maculosa*, but said: "There can be no doubt of the immense distribution of this species." His localities were "Indian Ocean, Mauritius, Polynesia, West Africa, West Indies, Brazil."

Iredale (1929, p. 345) recognized the separate identity of the West Indian shell, but took a different view of the allocation of the name *perdix*: "The case of the Linnaean species *Buccinum perdix* requires consideration, as forms are found in the West Indies, as well as in the Pacific Ocean, and these are certainly distinguishable. The Linnaean specific name should be restricted to the former, and Blainville's name *rufum* used for our species" (italics mine).

Synonyms of the Indo-Pacific *perdix* are: *Cadus coturnix* and *meleagris* Röding, 1798; *Perdix reticulatus* Montfort, 1810, referred to both regions; *Dolium rufum* Blainville, 1829; and *Dolium plumatum* Green, 1830.

The West Indian *maculosa* equals *Helix sulphurea* C. B. Adams, 1849 and 1850; *Dolium pennatum* Mörch, 1852; and *Dolium album* Conrad, 1854. The Brazilian form was called *Dolium perdix* β *braziliana* by Mörch, 1877.

Both species are placed in the genus *Tonna* Brönnich, 1771.

¹ *Dolium rufum* is a Blainville name (1829, p. 503), which Winckworth and Tomlin questionably referred to the male of *perdix*.

A correctly marked species of *perdix* is present in the Linnaean collection in London. The specimens in the Uppsala collection are *perdix* and properly labeled.

The best recent figures of both *perdix* and *maculosa* are found in Turner's paper (1948, pp. 170, 171). The earliest post-Linnaean figure of *perdix* is that of Martini (1769-1777, vol. 3, pl. 117, fig. 1079). Under the name *Dolium perdix* Martini supplied three figures (1078-1080). Of these, figure 1080 was probably based on a specimen of *maculosa*, and *maculosa* is also represented in his synonymy by the Seba figure (pl. 68, fig. 16) which Dillwyn cited for that shell. Tyron's figure (1879-1888, vol. 7, pl. 3, fig. 15) is clearly *perdix*. As said above, he did not list *maculosa*.

Buccinum pomum

1758, *Systema naturae*, ed. 10, p. 735, no. 379.

1767, *Systema naturae*, ed. 12, p. 1197, no. 441.

LOCALITY: Not given in 1758: "Ad Javam" (1767).

"B. testa ovata cincta sulcis obtusis, apertura dentata . . . Anfractus albi, cingulis 12 s. 14 elevatis lutescentibus. Spirae summus apex nitidus."

The subdescription was added in the twelfth edition, as was the locality.

The description fails to mention most of the distinctive characteristics of the species, particularly its heavier structure, the irregularity and distortion of the central plaits on the columella and parietal wall, and the semicircular notch or sinus on the anterior portion of the columella. The phrase "apertura dentata," however, is sufficient to distinguish *pomum* from all the other Linnaean Tun shells and may therefore be said to define the species. Indeed, this phrase makes it the only completely unequivocal description of any of this group in the "Systema." The four figures cited in the synonymy (Barrelier, 1714, pl. 1325, fig. 12, see Bibliography; Rumphius, pl. 27, fig. B; Gualtieri, pl. 51, fig. C; and Argenville, 1742, fig. L) need not be discussed in detail, as they are all recognizable as the *pomum* of authors. A further characteristic figure, "List. 792," was added to the synonymy by Linnaeus in a manuscript note in his copy of the twelfth edition, where he also added the words "colum[ella] vix perforata." The locality is

correct, although too restricted, as the species ranges throughout the Indo-Pacific from the Red Sea to the Hawaiian Islands. The shell was thus easily recognized by Linnaeus' successors at an early date. Complete confirmation of its identity is given by the presence of a marked specimen in the Linnaean collection in London.

I cannot find that the name *pomum* was used for the species by any of Linnaeus' predecessors.

In the dismemberment of *Buccinum* Linné, *Tonna* Brünnich, 1771, was the first name given to the group of Tun shells. It was, however, a genus without species, but the circumstances of its validation as of 1771, with *B. galea* Linné as type species, is discussed on page 159, above (see also Turner, 1948, pp. 168-169.) After Linnaeus, *pomum* was first used by Martini in 1773 (1769-1777, vol. 2, p. 59), but only in synonymy, Martini's shell being called *Cassis labrosa*. Born was the first of the post-Linnaean writers to use it as a good specific name (1780, p. 240). Röding (1798, p. 151) listed it in his genus *Cadus*, and in 1807 Link erected the genus *Cadium* for the reception of Linnaeus' Tun shells, including *pomum* as his first species, and noting Röding's *Cadus* in the synonymy of his new genus. Lamarck revived the name *Dolium* (see p. 159, above), in which he also placed *pomum* (1822, vol. 7, p. 261), along with the rest of the Linnaean Tun shells. Valenciennes' *Malea* (1832, p. 325) was the first name proposed for the heavier, more solid species with a dentate lip into which *pomum* falls. Valenciennes listed only two species, *M. latilabris*, a new name for *Cassis ringens* Swainson, 1822, which he placed in synonymy, and *M. crassilabris*, which is *pomum* Linné. The type species is *latilabris*, by subsequent designation, Herrmannsen, 1847, and Gray, 1847.

Malea is almost universally used for *pomum* and its congeners today. In 1929, however, Iredale (p. 345) proposed to transfer *pomum* to a new genus, *Quimalea*. His argument is as follows: "For some years, *Malea* was used, as the species (*pomum*) obviously was generically separable from either the type of *Tonna*, *galea* Linné, or of *Cadus* Bolten, *perdix*, and I had anticipated using *Cadium* Link, but in order to preserve

Malea for his American shells, Woodring (Carnegie Publ., 385, p. 311, 1928)¹ has designated *perdix* as the type of *Cadium* also. *Malea*, however, is not applicable to *pomum*, as its type species (*latilabris*) [*Cassis ringens*] is just as definitely not congeneric, as either of the 'Tonnas' with unarmed mouth. It becomes, therefore, necessary to introduce a new generic name *Quimalea*, naming *pomum* as its type."

The present writer is unable to separate *pomum* from Valenciennes' *latilabris* generically. They both have a strongly dentate lip, and I can point out no other characteristic, of the shell at least, in which the two species differ sufficiently to justify placing them in different genera. I am therefore constrained to disagree with the suggestion of Iredale. *Quimalea* has not been generally used in the United States, although Dietrich and Morris (1953, p. 17) used it in a faunal list.

The description of *pomum* in the "Museum Ulricaë," after repeating that in the tenth edition, added details omitted in the "Systema." The word "solida" and the phrases "utrinque denticulata" and "labium exterius reflexum, gibbum, repandum" confirm the accepted identification beyond a doubt. One phrase is, however, equivocal: "Simillima B. Dolio, sed minor, durior, ponderosior." Why Linnaeus should have compared *pomum* with *dolium* is not understood, even though he differentiated the two by certain obvious characteristics. The same confusion of the two species is seen in the labeling in the Uppsala collection. A specimen of *pomum* is found with the label "*B. Dolium*." Moreover, two specimens of *Dolium costatum* Deshayes, 1844, are present also labeled *dolium*. Were it not for the confusing statement in the "Museum Ulricaë" description we would put this down to a transfer of labels. As it is, we are tempted to think that there is a possibility that Linnaeus, who made a clear distinction of the two species in the "Systema" descriptions, temporarily changed his mind as to his conception of their identities in the "Museum."

The earliest post-Linnaean figures of *pomum* (Martini, 1769-1777, vol. 2, pl. 36, figs. 370-

¹ Woodring's "American shells" refer to the *Malea* species found in the Tertiary of Jamaica. *Malea* is not found Recent in the western Atlantic.

371, dorsal and apertural views) are fairly characteristic, although conventionalized, representations of the species, and the sinus in the columella is not shown.¹ It is possible that the artist believed that the specimen on which the figure was based was a damaged shell, and tried to reproduce it in its supposed original condition. The best modern figure is found in Reeve (1843-1878, vol. 5, *Dolium*, pl. 4, sp. 6). Its only defect is that the umbilicus is larger than it should be and as it is described by Linnaeus in the manuscript note above referred to.

Buccinum dolium

1758, *Systema naturae*, ed. 10, p. 735, no. 380.

1767, *Systema naturae*, ed. 12, p. 1197, no. 442.

LOCALITY: "In M. Siculo" (1758), "in M. Siculo, Africano" (1767).

"B. testa ovata cinctis sulcis obtusis remotis, cauda prominula."

Although the great majority of writers today find little difficulty in referring the Linnaean description to the shell now known as *Tonna dolium*, its history has been complicated by the existence of a group of species closely related to it of which the synonymies, as well as the synonymy of *dolium* itself, are in a state of great confusion. One has only to read Vredenburg's paper on the Doliidae (1919) to appreciate the complexities of this group.

Tonna dolium is usually a smaller shell than either *olearium* or *galea*, although it is considerably thicker in structure. It is markedly globose except for its long canal. Its sculpture consists of from 13 to 15 rounded, widely spaced spiral ribs, thickly maculated with quadrate reddish brown spots or longitudinal lines. The suture is canaliculate and the spire moderately depressed. Elevated threads occur, in most specimens, in all the intercostal spaces, there being three such threads in the first two spaces, two in the fourth, and one thread in each of the remaining spaces, becoming progressively obsolescent towards the base of the shell. This progression in numbers and strength is not constant, however, as various combinations of threads are found, and in some specimens it is difficult to detect more than a single thread after the

first interspace, and in others the threads occur only in the first two spaces. In the adult shell the lip is strongly crenulated by the rib terminations and on its outer aspect the lip is often pure white, slightly flaring, and without maculations. The aperture is wide. There is a considerable difference in the individual specimens in the amount of twisting of the columella and canal and the degree of bending of the canal. All *Tonna* species show a greater or less twist to the columella, but in *dolium* this is extremely marked. As to the canal, some specimens of *dolium* show a decided bend to the left, while others have a practically straight canal.

The description, which is identical in the tenth and twelfth editions, is as brief as that of each of the other *Tonna* species. The word "remotis," as applied to the ribs, and the phrase "cauda prominula," are the only items that serve to distinguish the species from its Linnaean congeners. The word "ovata" is hardly applicable to this globose shell.

The synonymy pictures at least three different species. The figure from Rumphius (pl. 27, fig. A) is almost certainly based on *dolium*. Although a dorsal view, it shows the widely spaced ribs and a recurved canal. The Gualtieri figure (pl. 89, fig. E),² that from Argenville (1742, pl. 20, fig. 6), and some of the Seba figures (pl. 70, fig. 1, and pl. 68, fig. 9) also show *dolium*. The remaining figures from Seba are not correctly chosen. *Buccinum echinophora* Linné appears in one (pl. 70, fig. 2). In the two others (pl. 70, figs. 3 and 4) it seems apparent that *B. pomum* Linné was the model. The Lister figure cited (pl. 899, fig. 19) is extremely bad, but may have been based on a specimen of *dolium*, although the aperture is so distorted that a categorical identification cannot be made. Of the two Buonanni figures (pt. 3, pls. 17 and 25), the first shows only a dorsal view but is fairly characteristic of *dolium*. The other is not usable, as it pictures a distorted and sinistral shell which is unidentifiable.

There remains only the figure from Adanson (pl. 7, fig. 6). This figure is also out of

¹ This sinus is much more deeply developed in *Malea ringens*.

² This figure was correctly printed as "39" in the tenth edition, erroneously given as "89" in the twelfth, and corrected to "39" in the manuscript notes of Linnaeus for his "revised twelfth edition."

place in the synonymy, but, as it has been the cause of so much of the debate on this species and has appeared in the synonymy of several other species, its history and the comments of certain writers on it are here discussed in greater detail. It shows, in a dorsal and apertural view, the widely spaced and spotted ribs of *dolium* and a columella only slightly twisted and bent. The outer lip is crenulate and slightly flaring. It is based, however, on a much smaller shell, although it appears from its characteristics to be adult, as a specimen in Adanson's "retained" collection (see Dodge, 1955, p. 53) is only 36 mm. in width. Adanson called his species "le Minjac." He cited for it several of the figures cited by Linnaeus for *dolium*, including the Buonanni figure (pl. 17) and the Lister, Rumphius, and Gualtieri figures. He noted (1757, p. 110) that the name "le Minjac" was borrowed from Rumphius, who had given it to a shell from Malabar which he had called "Cochlea striata sive olearia. Mal. Bia Minjac." Adanson also spoke of the 14 spiral ribs on the body whorl.

If his shell was in fact *dolium*, we then have either another instance of a species occurring both in the Indo-Pacific region and Senegal or of a fortuitous introduction of a foreign shell in the Senegal collection. The whole question is discussed by Fischer-Piette and his co-authors (1942, pp. 207-208) who identified "le Minjac" with another species after their examination of Adanson's "retained" collection. Their comments are quoted: "The Adanson species entirely conforms to the figure of *D. fimbriatum* Sowerby given by Reeve. That author cites 'le Minjac' as a synonym." As to the specimen in the Adanson collection they continued: "Specimens found (pl. 5, fig. 4): a truncated shell 36 mm. 5 in width, which appears to be the specimen figured [by Adanson]. It has an illegible inscription; two labels accompany it, mentioning 'le Minjac' from Senegal under the number 2416(4); the manuscript catalogue does not contain this number and nowhere mentions 'Minjac': it is therefore probable that Adanson did not have a duplicate,¹ which conforms to the fact that

dolium was not a Senegal shell, but an Indo-Pacific form. We may presume either an accidental addition to the collection or, more probably, a mixture of specimens in the collection of Adanson himself."

Thus the specimen found in the retained collection was not only believed by Fischer-Piette and his co-authors (1942, p. 208, pl. 5, figs. 4a, b) to be from a source other than Senegal, but was identified by them not as *dolium* Linné but as "*Dolium allium* Dillwyn, var. *fimbriata* Sowerby," both of which names refer to Indo-Pacific forms distinct from *dolium* although closely related.² Adanson must have known that his was not a Senegalese shell as he deliberately gave it a name derived from the Rumphius species from Malabar.

The facts of the case as to the identification of the Adanson description and figures and as to the possible common identity of "le Minjac" with either *allium* Dillwyn or *dolium* Linné are so equivocal and conflicting that it would be unwise to accept Linnaeus' citation of "le Minjac" in the synonymy of *dolium* as a well-chosen reference.

Lamarck (1822, vol. 7, p. 260) changed the specific name *dolium* to *maculatum*, undoubtedly to avoid tautonymy, to which he appears to have had a peculiar aversion. His *maculatum* is specifically referred to *dolium* Linné, and he cited most of Linnaeus' references for that name, including, unfortunately, the Adanson figure. His description is a great improvement over that of Linnaeus. He mentions the presence of the elevated lines between the ribs. His phrase "ovato-globosa, ventricosoinflata" is more descriptive of the species than the "ovata" of the "Systema." He used the term "tenui," however, as he did

consisted of such duplicates as he possessed. As a shell conforming to his figures of "le Minjac" was present in the retained collection and was described by Fischer-Piette and his co-authors, their remark that Adanson probably "did not have a duplicate" is not understood.

² Dillwyn's name *allium* is the earliest validly proposed name for that species. *Dolium tessellatum* Lamarck, 1816 ("Liste," p. 170; "Tableau encyclopédique," pl. 403, fig. 3; not described by Lamarck), *D. fimbriatum* Sowerby, and *D. costatum* Menke, 1829, are probably synonymous, although there is a great difference of opinion as to the relationship of some of these species to one another, many writers, including Lamarck and Reeve, treating one or another of them as equal to *B. dolium* Linné.

¹ Adanson's principal collection was lent by him to the "Cabinet du Roi" in Paris and was totally destroyed during the French Revolution. His retained collection

for all his species of the genus except *pomum*, although for *dolium* it does not express the fact that that shell is one of the thicker and more solid of the Tun shells.

Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 140) continued the use of the trivial name *maculatum*. They not only cited the "Minjac" of Adanson, but, in a footnote, even advocated the use of that name as having priority over both *dolium* and *maculatum*. This footnote is interesting, if not entirely comprehensible: "We should note that from the time of Linnaeus until today, at least 2 species have been united under the name of *Buccinum dolium* or *Dolium maculatum*: one of these species, to which the Minjac of Adanson may serve as type, has always 14 transverse ribs on the body whorl [dernier tour] and three on the spire [les premiers]. The other species, figured by Lister, Gualtieri, Argenville, Seba, Martini, has only ten or eleven principal ribs on the body-whorl and only two on the spire¹; finally, we must consider as a third species that figured by Favanne f. C. 2, pl. 27, which Mr. Keiner wrongfully, in our opinion, treated as the young stage of the *Dolium variegatum* of Lamarck.² Mr. Sowerby, in his *Genera*, and Mr. Reeve, after him, in his *Conchologica Systematica*, give the name *Dolium fimbriatum* to the Minjac of Adanson. We think that, in spite of their strangeness, the names of Adanson should be preserved as far as the date of their publication permits³; and it is

¹ I have considered the Lister, Gualtieri, and Argenville figures and two of the Seba figures cited by Linnaeus, as noted above, as showing *B. dolium* Linné. I am not disturbed by the fact that most of these, as drawn, have more or fewer ribs than *dolium*, because sculptural features, particularly the exact number of ribs, striae, tubercles, etc., were very casually treated by the pre-Linnaean draftsmen, and it is difficult to find a pre-Linnaean figure that shows the correct number.

² I am uncertain just what Favanne's figure shows. It has a strong resemblance to *tessellatum* "Lamarck," but it is a highly stylized figure. Deshayes and Milne-Edwards (*tom. cit.*, p. 143), in their discussion of *variegatum*, said: "This species, which comes from New Holland, seems to bear some relationship to *Dolium maculatum*, and especially to the Minjac of Adanson. We think that the two species should be preserved." It is not quite clear which two species are meant by these authors: "le Minjac" and *maculatum*, or "le Minjac" and *variegatum*.

³ This last phrase of Deshayes and Milne-Edwards is

for this reason that we propose to reestablish this species under the name of *Tonne minjac*, *Dolium Minjac*."

I agree that Lamarck's *maculatum* is only a new name for *dolium* Linné, but I do not agree, as said above, that "le Minjac" is the same shell. As to the preservation of that name, the suggestion was technically permissible in 1844. Although a vague rule of priority was already recognized at that date by some writers, although not yet promulgated, the fixing of the starting point of authoritative citation of names as the date of the publication of the tenth edition of the "Systema" was not even foreshadowed. To the mid-century writers Linnaeus was only another earlier author, although possibly considered as the most important.

Both Lamarck and Deshayes and Milne-Edwards gave the locality of *maculatum* as the East Indies and Senegal.

Reeve (1843–1878, vol. 5, *Dolium*, pl. 3, sp. 4) continued the use of the specific name *maculatum*, made it equal to *tessellatum* of the "Liste" and the "Tableau encyclopédique," and said: "This is a shell of *lighter growth* than the preceding [*D. fimbriatum* Sowerby], the ribs are less numerous and consequently more distant from each other, *the columella straighter, and the lip simple*" (italics mine). His figure shows only nine spiral ribs, whereas his figures of *fimbriatum* (*tom. cit.*, pl. 3, sp. 3a, b) show about 20 ribs. This greater number of ribs is not found in *fimbriatum* nor credited to it by other writers, nor have I noted any other writer who gives as few as nine ribs to *dolium* (*maculatum*). Contrary to his figure of *fimbriatum* his description of that shell notes only 14. He made *fimbriatum* a synonym of "Minjac."

Tryon (1879–1888, vol. 7, pp. 264–265) did not treat either *maculatum* or *fimbriatum* as good species but made them both varieties of *D. costatum* Menke, 1829. His only reference to the name *dolium* was as follows: "*D. cassis* (Bolten) Mörch; *Buccinum dolium* Linn.; *D. minjac* Adanson and *D. tessellatum* Encyc. Meth. are names given to the two

tantamount to saying that a name used by any pre-Linnaean writer should be preserved if it were the earliest use of that name. As far as I am aware, these authors never made such a suggestion as applying to any writer except Adanson.

varieties but not readily assignable. The Senegal locality is given on the authority of Adanson."

Vredenburg's monograph on the shells of the family Doliidae (1919) is a detailed discussion of the possible relationships of the various names referred to above. It should be read, if only to convince oneself of the confusion obtaining in this complex of species. He distinguished *dolium*, for which he still used the name *maculatum* Lamarck, from *tessellatum* Lamarck (1816, "Liste") and makes the latter equal to *fimbriatum* Sowerby, 1827, and *costatum* Menke, 1829, thus disagreeing with Tryon. He also disagreed with Fischer-Piette and his co-authors, as he synonymized "le Minjac" of Adanson with *dolium* Linné, as its sole synonym.

The most recent fixing of this species is found in the Winckworth and Tomlin catalogue of the genus *Tonna* (1933, pp. 206-213). On page 209 they list *dolium* as: "DOLIUM, *Buccinum*, Linné, 1758, Syst., p. 735. The type in the Linnaean cabinet = *maculatum* Lamarck (see Hanley, *Ipsa Lin. Conch.*, p. 240). The 1758 reference applied to this species; reference to Minjac Adanson (= *tessellatum*) was added in 1767. Good figures in Vredenburg, pl. 4. Gmelin's *dolium* is an aggregate of several species." This treatment is in accord with the present writer's own views, at least as to the names mentioned. Later (p. 210) they list "le Minjac" as a synonym of *tessellatum* "Lamarck" and *fimbriatum* Sowerby, and list *tessellatum* as a good species. Thus they apparently disagree with the 1942 conclusion of Fischer-Piette and his co-authors that "le Minjac" is *Buccinum allium* Dillwyn. They treat *allium* as a good species, but equal to *costatum*.

I have referred at length to the comments of a few writers among the many available on the subject of *dolium* and its close allies for the purpose of showing the wide difference of opinion as to this complex of species. The synonymies are in hopeless confusion, and the available figures are often in direct conflict, one with another. The confusion is so great that I am unable to take a categorical position as to the species *tessellatum*, *fimbriatum*, and *costatum*. When I say that the opinion of Winckworth and Tomlin is in accord with my own views, I do not use the

word "views" as connoting a settled conviction. I am, however, unwilling to associate *dolium* with "le Minjac" Adanson, and so far my opinion is based on conviction.

The name *maculatum*, which is still in use by some conchologists, should be placed in the synonymy of *dolium* in spite of its long-continued use.

As Hanley pointed out (1855, p. 240) the specimen marked for *B. dolium* in the Linnaean collection in London is the shell known in Hanley's day as *Dolium maculatum*, and therefore it may be accepted as the unquestioned type.

The species is now included in the genus *Tonna* Brünnich, 1771.

The description of *dolium* in the "Museum Ulricae" is clearly that of the *dolium* of the "Systema" and adds many confirmatory details such as "Labium exterius . . . reflexum, margine undato dentatum. . .," "Basis emarginata, reflexa," and "Color albidus annulis albo testaceoque alternatim variegatis."

Buccinum echinophorum

1758, *Systema naturae*, ed. 10, p. 735, no. 381.

1767, *Systema naturae*, ed. 12, p. 1198, no. 443.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa cingulis quatuor tuberculis, cauda prominente."

The description of this species is identical in the tenth and twelfth editions and is probably sufficiently explicit to have identified the species, even without the aid of the almost completely correct synonymy, the right locality, and the existence of a specimen of the *echinophorum* of authors, marked for this species, in the Linnaean collection in London. Only the figures from Buonanni (pt. 3, pls. 18 and 19), which are unrecognizable, should be expunged. The other four figures cited (Rumphius, pl. 27, fig. 1; Argenville, 1742, pl. 4, fig. P; Ginanni, pt. 2, pl. 5, fig. 43; Seba, pl. 68, fig. 18) were unmistakably based on *echinophorum* and have repeatedly been cited for it. The species is variable in the number of the spiral ridges that are tuberculate. Linnaeus' type specimen shows four, as called for in the description. Some individuals show five or even six. This variability was first recognized by Gmelin, who said (1791, p. 3472): "Cingulis nonnumquam 5."

The species belongs in the genus *Galeodea*

Link, 1807, of which it is the type species, by monotypy. *Morio* Montfort, 1810, *Cassidaria* Lamarck, 1822, and *Echinora* Schumacher, 1817, are all synonyms of *Galeodea*, and the present species has been from time to time included in each of these genera. In the case of *Echinora* Schumacher, the author called the present species *E. tuberculosa*. The continental conchologists have, in great measure, retained *Cassidaria*, and that name and *Morio* were much used, both in England and the United States, until recently, as Link's 1807 catalogue was extremely rare and only came to the general attention of conchologists with the publication of its conchological portion by Tomlin and Winckworth in 1931.

The only confusion that has existed among students is as to the relation between *echinophorum* Linné, *Buccinum tyrrhenum* Gmelin, 1791, *B. nodosum* Dillwyn, 1817, and *B. rugosum* Linné of the "Mantissa." Dillwyn described his *nodosum* (1817, pp. 586-587) as differing from *echinophorum* Linné "in being smaller, and in having five transverse belts, of which only the upper two are studded with tubercles." He made it equal to *B. strigosum* Gmelin and to Gmelin's variety "δ" of *echinophorum* Linné.¹ Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 6, footnote to *Cassidaria echinophora*) said: "We refer to this species the *Buccinum nodosum* of Dillwyn, because it is a mere variety, intermediate between it and the *Tyrrhenum*. This variety, after having been mentioned by Gmelin in the synonymy of *Echinophora*, is taken up again by him under the name of *Buccinum strigosum*, which constitutes a double use which it is necessary to suppress." Thus these authors, on the same facts, disagreed with Dillwyn on the validity of the name *nodosum*.

In regard to the *B. rugosum* of the "Mantissa," Dillwyn (*tom. cit.*, p. 587) listed a species with this name, which he referred to the "Mantissa" *rugosum*, to *B. tyrrhenum* Chemnitz, 1788 (1780-1795, vol. 10, p. 192, pl. 153, figs. 1461-1463), and to "*Buccinum echinophorum*, var.," by which he probably meant "var. γ" of Gmelin, and for which he

cited Martini (1769-1777, vol. 2, p. 88). This page of Martini lists two "varieties" of *echinophorum* Linné. It is difficult to determine which one Dillwyn meant. The only hint is that for one of them Martini cited a figure from Buonanni's "Musaeum Kirschnerianum" of 1709 (pt. 3, fig. 162) which Gmelin cited for *echinophorum*, var. "γ." The figure is not instructive. Deshayes and Milne-Edwards (*tom. cit.*, p. 8, footnote to *Cassidaria tyrrhena*) said of the latter shell: "One cannot be deceived: this species was known to Linné, listed and described by him in his *Mantissa plantarum*, p. 549, under the name of *Buccinum rugosum*. This Linnaean name should therefore be preferred to that of Chemnitz, adopted later by Gmelin, Bruguière, Lamarck, etc. Dillwyn is excepted, because he is, in effect, the first to have restored to the species its Linnaean name. Gmelin, as was his habit, gave several duplicate listings for this species; he first made it a variety of *echinophorum* with the figure 160 of Bonanni. He described it again under the name of *Buccinum Tyrrhenum* [a name] borrowed from Chemnitz, using the figure 160 of Bonanni in the synonymy again; finally, this same shell is again mentioned under the name of *Buccinum ochroleucum* [sic] which was based on the Gualtieri figure.² . . . Philippi united under the name *Tyrrhena* the two species of Linné, of Lamarck, and of the majority of conchologists; he thought, in effect, that the *Cassidaria echinophora* was a variety of *Tyrrhena*, and in that we share his opinion. We only remark that *Buccinum echinophorum* was described by Linné as far back as the 10th edition of the *Systema*, while *Buccinum tyrrhenum* is a Chemnitz species, much later than that of Linné. In a good nomenclature, the present species should retake the name of *Cassidaria echinophora*, and *Tyrrhena* should rank among its varieties." I have quoted their remarks both on *B. rugosum* and *C. tyrrhena* in full, in order to show not only the rather deceptive nature of their argument, but to illustrate an early expression of what has become the Rule of Priority.

Reeve (1843-1878, vol. 5, *Cassidaria*, pl. 1,

¹ Gmelin used the name *B. strigosum* twice, on page 3476 and page 3496, and in effect listed the first *strigosum* once more, as it is the same as variety "δ" of *echinophorum* Linné.

² *Buccinum ochroleucum* was based on Gualtieri, plate 43, figure 2; while Gmelin's *echinophorum* cited Gualtieri, plate 43, figure 3.

sp. 2) treated the question of the identity of the various names discussed above with no discussion whatever. He merely listed *Echinora tuberculosa* Schumacher, *Buccinum strigosum* Gmelin, *Buccinum nodosum* Dillwyn, and *Cassidaria tyrrhena* var. Philippi, all as exact synonyms of *echinophora* Linné. He did not mention the *rugosum* of the "Mantissa."

Tryon (1879-1888, vol. 7, p. 279), in his discussion of *echinophora* Linné, considered the *rugosum* of the "Mantissa" to be identical with, or at least a form of, that species, with a single nodose band near the shoulder. This description would apply to some individuals of *tyrrhena*, if we could call the shoulder coronation of the latter a nodose band.

The description of *rugosum* in the "Mantissa" is long but not entirely clear. The phrase "striis transversis, elevatis, numerosissimis" suggests *tyrrhena* rather than *echinophora*, and in fact there is a specimen of *tyrrhena* in the Linnaean collection marked for *rugosum* in Linnaeus' handwriting. This specimen is therefore to be taken as the type of *rugosum*, and confirms the conclusion arrived at by Deshayes and Milne-Edwards that the two names referred to the same species.

There has been considerable confusion in the labeling of *echinophora* and *tyrrhena* (*rugosum*) in collections, as the sculpture of each is variable, but the two should be readily distinguishable. The typical *echinophora* is provided with four nodose bands around the body whorl, but some forms have five or even six such bands, and in some there is only one band of nodes, which forms the coronation of the whorl. In *tyrrhena* the typical form has no nodes, but occasionally a specimen shows a coronation, sometimes partial or obsolescent, which recalls, so far as sculpture is concerned, the smoother forms of *echinophora*. The shape of the two shells is, however, quite different, *tyrrhena* being more pyriform than the more ventricose *echinophora*.

A specimen of *B. echinophorum* is also in the Linnaean collection in London and is properly documented. Thus Linnaeus was clearly aware of the difference between the two species.

The description of *echinophorum* in the "Museum Ulricae" definitely points to that species rather than to *tyrrhenum*, and the two specimens present are properly labeled.

It is figured in Reeve (1843-1878, vol. 5, *Cassidaria*, pl. 1, sp. 2a, b, showing the extremely nodose and the smoother forms). *Cassidaria tyrrhena* is figured on the same plate. The comparison of the pairs of figures of the two species in the "Tableau encyclopédique" (pl. 405, figs. 1a, b, 3a, b) well illustrates the sculptural difference between the two shells. The best early figures (Martini 1769-1777, vol. 2, pl. 41, figs. 407-408 for *echinophorum*; Chemnitz, 1780-1795, vol. 10, pl. 153, figs. 1461-1462 for *tyrrhenum*) are equally instructive.

Buccinum plicatum

1758, *Systema naturae*, ed. 10, p. 735, no. 383.

1767, *Systema naturae*, ed. 12, p. 1198, no. 444.

LOCALITY: "Ad Jamaicam" (1758, 1767).

"B. testa antice subplicata decussatim substriata, apertura dentata, cauda recurva."

This has always been considered a *species dubia*. The language of the description is not sufficiently explicit to tie it to any single member of the Cassididae, and the synonymy is discordant.

Linnaeus did not own a specimen of the shell he described, and there is nothing in his manuscript notes that adds anything to his description.

The synonymy is, indeed, a mixture of species. Buonanni's figure (pt. 3, pl. 156) was cited by Lamarck for *Cassis flammea* (Linné) and might be taken for that species. The figure from Gualtieri (pl. 40, fig. C) might pass for either *flammea* or *tuberosa* (Linné), although it is a dubious figure. Argenville's figure (1742, pl. 18, fig. D), which Linnaeus referred to with a query, is generally conceded to have been based on a specimen of *Buccinum zebra* Lamarck, 1822. It is undoubtedly a *Cassis*. The Seba drawing (pl. 73, fig. 10) resembles *Cassis flammea*, but I would not be willing to identify it unequivocally.

Dillwyn (1817, p. 588) described a *Buccinum plicatum* for which he referred both to the *plicatum* of the "Systema" and to *Cassidea crumena* Bruguière, 1789. The latter is now considered to be a mere form

of *Cypraecassis testiculus* (Linné). (See p. 182, below.) Most writers have felt that *plicatum* Dillwyn, while undoubtedly Bruguière's *crumena*, was not the *plicatum* of Linnaeus. Dillwyn's description gives us a very clear picture of *crumena* in the words "slightly plaited on the forepart, and somewhat decussated with striae." This conclusion, that Dillwyn's shell was not that of Linnaeus, is based not only on the vagueness of Linnaeus' description but on the discordance of his synonymy. Certainly none of Linnaeus' figures resembles *testiculus* or the form *crumena*.

There is, however, some evidence that could be used to identify Linnaeus' *plicatum* with *crumena*. The phrase "antice substriata," in the Linnaean description, when his habitual error of using "antice" for "postice" is taken account of, would apply to the latter shell, and, in fact, none of the other details of his description can be said to be actually antagonistic to that view. Moreover, the locality "ad Jamaicam" is correct for *crumena*. *Cypraecassis testiculus* is found in Jamaican waters, and the range of *crumena* is reported by Clench and Abbott (1943, p. 3) to be "probably co-extensive with *testiculus* Linné." In the light, however, of the unsatisfactory diagnosis of *plicatum* Linné, these questionable similarities do not seem weighty enough to be considered seriously.

Deshayes and Milne-Edwards (1835-1845, vol. 10, pp. 25-26, footnote) held, with considerable emphasis, that Linnaeus' *plicatum* was the same as *Cassis plicaria* Lamarck, 1822, basing their opinion on an interpretation of Linnaeus' synonymy. I disagree with this view, as I am unable to draw any conclusion from that heterogeneous group of species. Hanley (1855, pp. 241-242) also disagreed, saying: "I am compelled to differ from the views of that eminent conchologist Deshayes, who imagines it to have been identical with the *Cassis plicaria* of Lamarck. I find no grounds whatever for the supposition, since not one of the cited figures represents that shell, though our author, had he desired it, could have quoted an admirable portraiture of it in Seba's 'Museum' (vol. 3, pl. 53, f. 1), a work that he has peculiarly referred to for his representations of the

Cassides." Hanley then dissected Linnaeus' synonymy and came to a conclusion as to the identity of the species figured that was very different from that of Deshayes. He did suggest that *plicatum* might have been based on a senile specimen of *Cassis flammea*, but added, "as this is conjectural, it is far better to omit the species as too inadequately defined for positive identification."

One seems forced to the conclusion that *plicatum* Linné is not *plicaria* Lamarck. Nor can it be *crumena* Bruguière, as might be gathered from Dillwyn's inclusion of that species in the synonymy of his *plicatum*, which he referred also to the Linnaean *plicatum*. Hanley's tentative suggestion that it might be *Cassis flammea* seems so "conjectural," to use Hanley's word, that it need not be considered. The present writer, therefore, is compelled to leave it as a *species dubia*.

Buccinum cornutum

1758, Systema naturae, ed. 10, p. 735, no. 384.

1767, Systema naturae, ed. 12, p. 1198, no. 445.

LOCALITY: "In America" (1758, 1767).

"B. testa turbinata scrobiculis punctata coronata, apertura dentata, cauda recurva."

The descriptions are identical in the tenth and twelfth editions.

The descriptions of the species of the genus *Cassis* contained in *Buccinum* Linné are not sufficiently explicit to describe the appearance of these shells adequately or to identify them specifically. Their peculiar structure and shape, their great size and heaviness, the extraordinary development of the parietal shield, and the presence of prominent vestigial lip varices are not brought out in any of the descriptions. In identifying any of them one must rely on the cited figures and the amplified descriptions in the "Museum Ulricae." The only guidepost in the "Systema" diagnoses is the phrase "cauda recurva," although the marked curvature and reflexion of the anterior canal in these species might well have been more emphatically expressed. Several other groups have recurved canals, and, even in *Buccinum* Linné, other species showing a lesser degree of curvature in the canal are described by the same phrase.

The description of *B. cornutum* is an illus-

tration of these defects. From its language, indeed, one could hardly determine the species to be a *Cassis*. The name *cornutum* does not appear on Linnaeus' list of owned species, and no specimen of it is found in the collection in London. Once the genus is determined, however, the phrase "*scrobiculis punctata*" is of considerable help in fixing the species, and is quite possible that it was the basis of the early identification. These shallow, oblong pits are so numerous and close together that they give a very fine decussate sculpture to the whole shell. The Martini figures (1769–1777, vol. 2, pl. 33, figs. 348–249), while they are wretched and highly conventionalized drawings, do illustrate the artist's attempt to show these pit-like punctations. Martini, who called the shell *Cassis nodosa caelata*, referred it to the *cornutum* of Linnaeus.

The cited figures all unmistakably show a *Cassis*, but, with one possible exception, the sculpture is incorrectly reproduced. Typically in this species, there are three rows of spines on the body whorl, the upper row, at the shoulder, being the most highly developed and the most spinose. The other two rows are more tubercular, and are developed on slightly raised bands which partly encircle the body whorl but are often obsolescent or lacking. These bands are, in young or fresh specimens, sometimes spotted with brown, especially near the outer lip. The brown markings also appear through the overlay of the parietal shield. Occasionally a narrower raised thread occurs below the lowest row of spines or tubercles, which may have appeared to some of the early writers and artists as an obsolete row. None of the figures cited by Linnaeus adequately shows all these features.

The figure from Rondelet (1554–1555, pt. 2, p. 77) is not specifically recognizable. It is extremely deltoidal in shape and more nearly resembles *Buccinum tuberosum*. Rondelet called it *Murex triangularis*.

The Buonanni figure (pt. 3, pl. 155) reproduces the encircling bands of the shell, but shows only the row of spines at the shoulder and has a highly stylized color pattern. It is a dorsal view.

Rumphius' figure (pl. 23, fig. 1) is apparently copied from that of Buonanni, except that the spines are shown on the spire as well. It also is a dorsal view.

Gualtieri (pl. 40, fig. D) shows the row of shoulder spines and three rows of tubercles instead of two, but reproduces the fine decussate sculpture. It could be cited for *cornutum* except for its development of the last row of tubercles. It is a dorsal view.

Of Seba's four figures (pl. 73, figs. 7–8, 17–18), figure 7 has an exaggerated color pattern like the figures from Buonanni and Rumphius. It shows the decussate sculpture, but lacks all other sculpture except the shoulder row of spines. Figure 8, an apertural view, was probably based on *cornutum*. Figures 17 and 18 are both dorsal views and show only the upper row of spines. In brief it is an extremely disappointing and uninformative synonymy.

Linnaeus' American locality is incorrect, as the species is native only to the Indo-Pacific.

Martini's early identification of the species has been noted. Chemnitz, in 1795 (1780–1795, vol. 11, p. 71, pls. 184–185, figs. 1790–1791), described and figured a *Cassis labiata* as being close to *cornutum* but distinct, although he cited for it the good figure of *cornutum* from Rumphius. He did not mention Martini's earlier identification of the latter name. He said: "For a while I was inclined to consider this broad-lipped Helmet Shell as a remarkable variety of the horned shell which . . . was named *Buccinum cornutum* by Linné." He then attempted to distinguish his "species" by saying that *labiata* was "markedly thicker, stronger, heavier, its apex flatter, blunter and more compressed, the spines at the top of its body whorl larger, thicker and longer than in *Buccinum cornutum* Linné."

Since Chemnitz, however, *labiata* has not been recognized except as a form of *cornuta*. Lamarck (1822, vol. 7, p. 219) listed it as a synonym of *cornuta*, and later writers, when they mentioned it at all, followed his example. Reeve (1843–1878, vol. 5, *Cassis*, text to pl. 1, sp. 2) said of the forms of *cornuta*: "The *C. cornuta* assumes two very distinct varieties of form, one extremely broad and ventricose at the base of the spire, attaining rather the larger size; the other of a more oblong form, in which the lip is more widely expanded into a flattened plane. It is the latter variety, of which Chemnitz has given two admirable figures in

Conchylien Cabinet, vol. 9 [sic], pl. 184–185) under the name *Cassis labiata*." The two forms are readily distinguishable by the features mentioned by Reeve. The specimens of form *labiata* seen by the present writer, however, tend to be larger than the typical form rather than smaller. Reeve was misled by Linnaeus' American locality, as he located the species in the West Indies, as well as the Moluccas and the Pacific islands. It is probable that Linnaeus himself had confused *cornutum* with the shell later called *Cassis madagascariensis* by Lamarck, a western Atlantic species that much resembles *cornutum*.

Many authors have referred to the great difference between the young and adult individuals of this species, and have been able to see these differences illustrated in the early descriptions. Dillwyn (1817, pp. 588–589) said that the adult shell was described in Bruguière's *Cassidea cornuta* (1789, 1792, pt. 2, p. 435), while Lamarck, in the "Système" of 1801, Linnaeus in the twelfth edition of the "Systema naturae," and several other early writers, including Born, Schröter, and Gmelin, as well as Bruguière on page 434 of the work mentioned, described only the young shell. The pertinent descriptions seem to bear out this conclusion. Dillwyn added: "Linnaeus appears only to have known this shell in the early stages of its growth." I agree that whatever specimen Linnaeus saw must have been a young shell. Otherwise he would have mentioned the three prominent rows of spines on the body whorl, as he did refer to the dorsal spines in the descriptions of the two following species, *rufum* and *tuberosum*.

Buccinum cornutum is correctly placed in the genus *Cassis* Scopoli, 1777, and is its type species, by subsequent designation, Montfort, 1810. A number of other names have been given to this group in the Cassidae. It is equal to *Cassida* Brönnich, 1771, not Linné, 1758 (Insecta), nor Agassiz, 1846; *Cassidea* Bruguière, 1792, not *Cassidea* Link, 1807; *Cassinea* Rafinesque, 1815; *Goniogalea* Mörch, 1857; *Fimbriola* "Megerle von Mühlfeld" Scudder, 1882; *Galeodocassis* Sacco, 1890; and *Cassisoma* Rovereto, 1899.

The description of the species in the "Museum Ulricae" adds much detail omitted in the "Systema" and confirms the identifica-

tion not only by its language, but by the restriction of its synonymy to the two most accurate figures cited in the "Systema," those of Gualtieri and Rumphius. The description suggests that Linnaeus was here describing an adult individual of *cornutum*, except for the phrase "magnitudine pugni," which would indicate a subadult shell. The specimen of *cornutum* in the Uppsala collection is, however, an adult shell that measures over 11 inches in height.

The best figure of the species is found in Reeve (1843–1878, vol. 5, *Cassis*, pl. 1, 1, sp. 2). It is not figured in the "Tableau encyclopédique."

Buccinum rufum

1758, Systema naturae, ed. 10, p. 736, no. 385.

1767, Systema naturae, ed. 12, p. 1198, no. 446.

LOCALITY: "In Oceano Americano" (1758); "in O. Americano" (1767).

"B. testa decussatim striata: cingulis nodosis interinctis linea gemina, apertura dentata, cauda recurva."

The description is identical in the tenth and twelfth editions. The species was recognized by all of Linnaeus' successors, but I feel sure that it was the expanded and characteristic description in the "Museum Ulricae," together with the nearly accurate synonymy, which fixed the species. In the "Systema" the shell was said to be "decussatim striata," an equivocal phrase to describe the few prominent and thick spiral cords and the numerous longitudinal threads which cross them. In the "Museum Ulricae" the word "decussatim" is omitted. The "Systema" says that "linea gemina" are found between the rows of tubercles. The number of these minor spiral lines is variable, and they decrease in number, from four down to one, from posterior to anterior. The "Museum Ulricae" recognizes this point of variation and somewhat more accurately says: "rugae 2 seu 3 conjunctae cingunt inter nodos." There is also a reference to the fact that the tubercles are larger at the anterior [sic] end of the body whorl, and are arranged in four rows. In all specimens seen by the present writer the fourth (anterior) row is only faintly indicated and then only on the

¹ This is another example of Linnaeus' confusion as to which was the anterior and which the posterior end of the shell.

columellar side of the whorl. The "Museum Ulricaë" also mentions the mucronate apex of the spire, the reflexion of the lip and its dark spots, and the reddish color of the whole shell, particularly of the aperture, columella, and lip. I have not seen the color form said to be "tota albo colore" in the "Museum," and it may have been a worn and bleached shell.

The synonymy of *B. rufum* is correct, with the exception of the figures from Seba. Rumphius (pl. 23, fig. B), Barrelier (pl. 1325, fig. 29), Gualtieri (pl. 40, fig. F), and Regenfuss (pl. 12, fig. 69) all show fairly accurate representations of the *B. rufum* of authors. The Seba figures (pl. 73, figs. 2-6, 9) are not satisfactory. Some show no dorsal nodes.

The locality is erroneous, as is that of *B. cornutum*, the preceding species. The species is from the Indian Ocean, though its range extends into the Pacific as far as Japan and the Philippines.

Bruguière [1792 (1789, 1792), pt. 2, p. 427], in describing *Cassidea pennata* (Gmelin), 1791, voiced his suspicion that the shell was merely the young of *B. rufum*, although he listed them separately. Dillwyn (1817, p. 590) was of the same opinion. Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 32), however, disagreed, pointing out that *pennata* lacked tubercles on its body whorl and had no parallel white streaks which are seen on the lower portion of the whorl in *rufum*. In the light of the great differences between the juvenile and adult individuals of the present species, these objections are captious. These authors, however, identified *Buccinum pullum* Born, 1780, with *pennatum* Gmelin, but agreed that the former was based on a young specimen of *rufum* Linné. Their latter observation, contained in a footnote, is inconsistent with the statement in their description, that *pennata* was distinct from *rufum*. Reeve (1843-1878, vol. 5, *Cassis*, pl. 8, sp. 20) reverted to the opinion of Bruguière and Dillwyn and referred both *pennatum* and *pullum* to the young *rufum*. *Buccinum pennatum* is probably the shell shown by Martini (1769-1777, vol. 2, pl. 36, figs. 371-373), and it is well illustrated by Reeve (*loc. cit.*). Since Reeve's day both *pulla* and *pennata* have been considered

conspecific with *rufa*, being younger life stages of the shell. Tryon, for instance, said (1879-1888, vol. 7, p. 273) that *rufa* "is *Buccinum pennatum* and *B. ventricosum* of Gmelin, *B. pullum* of Born, the first and last named for the juvenile shell." His figures (*tom. cit.*, pl. 3, figs. 57-58) are excellent.

In addition to the synonyms noted above, *Cassida os-tauri* "Humphrey" of the "Museum Calonnianum" is thought by Bayer (1935, p. 96) to have been identical.

Buccinum rufum Linné now belongs in the genus *Cypræacassis* Stuchbury, 1837, of which it is the type species, by original designation.

An authoritatively marked specimen is present in the Linnaean collection in London. The species was described in the "Museum Ulricaë," but no specimen is found in the Queen's collection today. The "Museum" description adds much useful data to complement the brief and unsatisfactory description in the "Systema," such as: "Testa . . . crassa, solida, magnitudine pyri," "nodi obtusi," "striae longitudinales, numerosissime," "apertura rufo," "labium exterius reflexum maculis fuscis," and "color rubicundus maculis fuscis."

In addition to the figures already cited, a good but somewhat conventional figure is to be seen in Martini (1769-1777, vol. 2, pl. 32, fig. 341).

Buccinum tuberosum

1758, *Systema naturae*, ed. 10, p. 735, no. 382.

1767, *Systema naturae*, ed. 12, p. 1198, no. 447.

LOCALITY: Not given in tenth edition. "In O. Americano" (1767).

"B. testa cingulis duobus tuberculosi, cauda recurva."

The above description was the same in the tenth and twelfth editions. There is evidence, however, that Linnaeus was not describing the same shell in the two editions. In the tenth he appended to his description the words "An prioris varietas?" As the preceding species in that edition was *B. echinophorum*, a shell that is so remote in appearance from *tuberosum* that there would seem to be no possibility of confusing them, we are left in ignorance of exactly what Linnaeus had before him, unless it was the species later called *Cassidea tyrrhena* by

Bruguère, 1792 (*Buccinum tyrrhenum* Gmelin, 1791, and *Cassidaria thyrrena* [sic], Lamarck, 1822). These two species are very close except in the degree of nodosity, and this difference is expressed by Linnaeus in the respective descriptions of *echinophorum* and *tuberosum*, 1758, although, if he were describing *tyrrhena* as *tuberosum*, he over-emphasized the importance of the tubercles or spines. As is noted in the discussion of *echinophorum* (p. 172, above) that shell usually has three or four rows of prominent tubercles, in addition to the nodular or spinose coronation of the whorl, whereas most specimens of *tyrrhena* lack the tubercles or spines entirely, although one or two partial or obsolescent rows are seen in some individuals.

This is the only instance in the conchological portion of the "Systema" as to which it may fairly be said that Linnaeus may have changed his concept of a species in the interval between the tenth and twelfth editions of the "Systema," although, in the latter edition, he changed the specific name in several instances. Hanley (1855, p. 243) called attention to this change, but I have not seen it referred to by any other author, except for the query placed by Dillwyn (1817, p. 590) in his synonymy of *B. tuberosum*: "Linnaeus. Syst. Nat. p. 1198?" Why Dillwyn should have queried the twelfth edition shell instead of that of the tenth is not understood.

In the twelfth edition, Linnaeus, while he used the same description, except for the omission of the equivocal phrase quoted above, not only added a correct locality for *tuberosum*, but supplied a synonymy that clearly shows that species, one plate of which (Gualtieri) was available to him at the time he wrote the tenth edition. His failure to use this figure in the 1758 edition, when Gualtieri's work was in his library and was constantly referred to by him, seems fairly cogent evidence that he was not describing the *tuberosum* of authors, as he did later. The one defect in the 1767 description, as it applies to the *tuberosum* of authors, is not only its brevity but the fact that he restricted the number of rows of tubercles to two, whereas *tuberosum* usually shows three.

In the synonymy two references are given.

The Gualtieri figure (pl. 41, all figs.) shows excellent and unmistakable pictures of the *tuberosum* of authors, and, when considered with the brief though accurate description and the locality, is sufficient to fix the species. The other reference ("Labat. itin. 5, p. 262") was not available to the present writer,¹ but Hanley (*loc. cit.*) reported that it showed two figures, one of which was "decidedly the *tuberosa* of authors."

A specimen of *tuberosum* is in the Linnaean collection in London, but because of its size it is not found in the cabinets but stored apart. While it is marked with the proper numerals in Linnaeus' hand, its authority as the type is somewhat impugned by the fact that a specimen of the *labiata* form of *Buccinum cornutum* (see p. 175, above) is also present, marked with the same numerals. This may have been due to an error on the part of Linnaeus, as the two are readily distinguishable. However, *cornutum* and particularly its form *labiata* have a roughly triangular shape, although it is not so decidedly deltoidal as that of *tuberosum*,² and it is possible that Linnaeus conceived them to be forms of a single species.

The *B. tuberosum* of the "Museum Ulricae" is also not entirely free from doubt. The good Gualtieri figures, or at least one of them, designated as figure I, are again cited, and the descriptive details there added correct the error in the "Systema" as to the number of rows of tubercles or spines by the use of the phrase "tuberculis serie gemina aut terna dispositis." Nevertheless, the description of the aperture is inapplicable to *tuberosum*. This led Hanley (*loc. cit.*) to conclude that the diagnosis in the "Museum Ulricae" could not be referred to that in the twelfth edition and that the 1764 species could not be identified. It is suggested that the inconsistency is not of major importance as compared with the remainder of the description and the figure cited. The Uppsala collection contains a specimen of *tuberosum* bearing the

¹ Labat published three "Voyages," and from the copies available to the writer, one of which seems to be incomplete, it is not possible to determine in which publication the figures of *tuberosum* appeared.

² Rondelet (1558, pt. 2, p. 49; 1554-1555, Testacea, pt. 2, p. 77) gave the name *Murex triangularis* to *cornutum*.

proper label, and, while the labels in this collection are not conclusive, it must be admitted that virtually all the evidence points to the common identity of the 1764 and 1767 shell, except the single phrase in 1764 relating to the aperture, "lunato-obovata."

The present species belongs in the genus *Cassis* Scopoli, 1777, and is therefore cited as *Cassis tuberosa*.

It is the most abundant of the western Atlantic members of the genus and has the widest range, being found from the latitude of Cape Hatteras south to Brazil, on the southeast coast of Florida, and in the Antilles. It has been confused with *Cassis madagascariensis* Lamarck, 1822 (*Cassis cameo* Stimpson, 1860), which occupies the northern part of its range, as far south as the Antilles, but can be distinguished from that species both in sculpture and coloration. It has a fine netted sculpture, whereas the sculpture of *madagascariensis* is coarsely reticulate. Its color is buff, decorated with brown zigzag or crescent-shaped markings, while the other shows no distinct pattern, being of a pale cream color with a salmon parietal shield and lip. It seldom reaches the great size of some specimens of Lamarck's species. The most obvious feature that distinguishes it from all other species of the genus is the triangular shape of the parietal shield, the upper corners of which are often decidedly alate. Lamarck's vernacular name for the species, "Casque triangulaire," describes this feature.

Cassis rotundata Perry, 1811, is a synonym. *Buccinum striatum* Meuschen, 1787, is considered by some writers to have been based on a young individual of *tuberosa*.

The best figure of the dorsal aspect of the shell is the photographic reproduction in Clench (1944, pl. 5). The best colored figure of the apertural side of the shell is that of Reeve (1843-1878, vol. 5, *Cassis*, pl. 3, sp. 7). The shell is also figured in the "Tableau encyclopédique" (pl. 406, fig. 1, and pl. 407, fig. 2).

Buccinum flammeum

1758, *Systema naturae*, ed. 10, p. 736, no. 386.

1767, *Systema naturae*, ed. 12, p. 1199, no. 448.

LOCALITY: Not given in either edition.

"B. testa subplicata subcoronata, apertura dentata, cauda recurva."

The entire diagnosis is identical in the tenth and twelfth editions. The description is hardly more illuminating than that of the other Linnaean members of the genus, and one somewhat equivocal word is used. The shell is said to be "subcoronata." By this word Linnaeus ordinarily meant the presence of spines or tubercles around the top of the body whorl. This species does indeed have a circle of protuberances at the shoulder, but has also two further rows around the median area of the whorl, and in this respect its nodosity is similar to that of *tuberosa*, although not so highly developed. Why Linnaeus should have mentioned *flammeum* as a coronate species when *tuberosum* is not so described is not understood, unless he was familiar only with the young shell of *flammeum* in which only the shoulder row of tubercles is developed. This explanation finds confirmation in the description in the "Museum Ulricae," referred to below. The one detail of the sculpture that principally distinguishes it from *tuberosa* is that it is described as "subplicata." It has a series of close-set longitudinal plicae over the whole body whorl. These are apparent even in the young shell, whereas in *tuberosa* the wrinkled longitudinal rugosities are mere growth lines and are, moreover, crossed by equally close-set but broader spiral ribs, giving the shell a finely netted or reticulate appearance. The two species are often confused, but *flammeum* is readily distinguishable not only by its lack of reticulate sculpture but by the fact that its parietal shield is almost oval rather than deltoidal, by the cream color of the shield, by the lack of brown color between the teeth of the lip, and by its generally smaller size.

I seriously question whether the species could have been categorically identified without the aid of the synonymy, which, however, is only half correct. The crude figure from Buonanni (pt. 3, pl. 161) apparently shows the *crumena* of Bruguière, which is mentioned above under *Buccinum plicatum*,¹ and, indeed, was cited by Linnaeus for the latter species as well. He either forgot that he had already used the figure for another species, or, as is often the case, was seeking the

¹ See also discussion of *Buccinum testiculus* (p. 181, below).

nearest approximation to the shell, although in this instance he chose a very poor approximation, as its sculpture is far removed from that of even the young *flammeum*. The Rumphius figure (pl. 23, fig. 2) is unquestionably based on the *flammeum* of authors, and was selected by Clench (1944, p. 13) as the type figure.

Linnaeus did not own a specimen of *flammeum*, as it does not appear on his list of owned species, and there is no specimen of it in the Linnaean collection in London.

It is not found on the American coast, its range being restricted to the Bahamas and the Lesser Antilles.

The description in the "Museum Ulricae" is more informative. It suppresses the equivocal word "subcoronata" and substitutes "mucronata" therefor, although it is difficult to decide whether Linnaeus referred to a mucronate spire or to the fact that the upper row of spines, or, at least, the most prominent spines, was sharp. Both interpretations are descriptive of the juvenile *flammeum*. It also adds the useful phrase "Striae longitudinales, sursum imbricatae." As the synonymy of the "Museum Ulricae" was confined to the figure from Rumphius taken from the "Systema naturae," Linnaeus' successors tacitly selected the shell there shown as the representative of *flammeum*. The shell labeled *flammeum* in the Uppsala collection is shown in the microfilm of the collection as a dorsal view of a shell 9 inches in height, which far exceeds the maximum height of the present species. The picture is not clear, and the specimen may be *tuberosum*.

Linnaeus failed to cite an excellent set of figures from Seba (pl. 73, figs. 10, 11, 14, 15, 19, 20), which are all clearly *flammeum*. These figures are, however, all of adult shells and, as already suggested, it is questionable whether Linnaeus was familiar with the adult. This is further suggested by Dillwyn (1817, p. 591), who referred the "Junior" *flammeum* to the diagnosis in the twelfth edition, as well as to the *flammeum* of Martini, Born, Schröter, and Gmelin. Dillwyn said of the tubercles on the body whorl, "... these are wanting in young shells, from one of which the description in the Systema Naturae was obviously taken." Lamarck (1822, vol. 7, p. 220) discussed the difference

between the young and mature shells but did not suggest that *flammeum* Linné was based on a young specimen.

The species belongs in the genus *Cassis* Scopoli, 1777, where it has been consistently placed by almost all workers since Lamarck.

The only synonym of the species is *Cassis alba* Perry, 1811.

Cassis flammea is figured by Reeve (1843-1878, vol. 5, *Cassis*, pl. 5, sp. 12). The best dorsal view is found in Clench (1944, pl. 6). The figures in the "Tableau encyclopédique" (pl. 406, figs. 3a, b) are clearly of the immature shell.

It is not *Buccinum flammeum* Bruguière, 1789, which is *Buccinum laevissimum* Gmelin, 1791.

Buccinum testiculus

1758, Systema naturae, ed. 10, p. 736, no. 387.

1767, Systema naturae, ed. 12, p. 1199, no. 449.

LOCALITY: "Ad Jamaicam" (1758, 1767).

"B. testa obovata decussatim striata laevigata, striis elevatis longitudinalibus, apertura dentata, cauda recurva . . . Labium interius oblitteratum et fere nullum."

The description is identical in the tenth and twelfth editions. It is somewhat more informative than that of the four preceding species of *Cassis*. The word "obovata" takes it out of the group of cassids that have a more or less trochiform shell and a heavy, flattened ovate or deltoidal parietal shield. The phrase "striis . . . longitudinalibus" distinguishes it from *B. flammeum*, and the word "laevigata," which, as the shell is not "smooth," must refer to the absence of tubercles, is correct, although not particularly well chosen. The subdescription is confusing. Why should the covering of the inner lip with a heavy callus have been mentioned for this species, when it was not noted in the preceding four species to which it would be much more applicable? An abbreviated manuscript note in Linnaeus' copy of the twelfth edition adds further useful details: "Col[umella] adglut[inata], p[er]for[ata]; lab[ium] exte[rius] extus maculatum." The word terminations were supplied by Hanley (1855, p. 245).

The synonymy is correct with one exception. The Seba figures (pl. 73, figs. 17-20) are based obviously on *B. flammeum*, the

preceding species.¹ All the remaining figures (Buonanni, pt. 3, pl. 162; Rumphius, pl. 23, fig. 3; Gualtieri, pl. 39, fig. C; and two other Seba figures, pl. 72, figs. 19–20) show what is obviously *testiculus*.

The identification of the species with the shell now known by that name is completely confirmed by the presence of a marked specimen in the Linnaean collection. Even before the collection became known to conchologists, however, the species was identified by all the early post-Linnaean writers, mainly, I suspect, because of the good figures from Gualtieri and Rumphius cited by Linnaeus.

The form *crumena* Bruguière, 1792 (*Cassidea crumena* Bruguière), has a range which is probably coextensive with that of the typical *testiculus*. It is distinguished only by having a single or double row of somewhat wavy plications just below the shoulder of the body whorl. It is found with the typical form, although it is rare, and, as there is a complete chain of intermediates between the plicated and the typical reticulated form, it cannot be separated as a good species. Many early authors have, however, done so. Dillwyn properly placed it in the synonymy of his *Buccinum plicatum* (1817, p. 588), which he wrongly referred to *B. plicatum* Linné (see p. 174, above). Lamarck (1822, vol. 7, p. 222) listed *crumena* as a good species. Deshayes and Milne-Edwards (1835–1945, vol. 10, p. 25) followed Lamarck's example, and, in a footnote to *Cassis plicaria* Lamarck (*tom. cit.*, pp. 25–27) called attention to the

fact that the Buonanni figure 161 had been cited for *Cassis plicata* by Martini, a name that Martini erroneously referred to *plicatum* Linné. The entire footnote should be read in order to trace back the origins of the error of identification involved. It is interesting and curious to note that Lamarck, and his editors, placed *crumena* Bruguière in that group of *Cassis* that Lamarck headed "[a] Spire ayant bourrelets," along with *cornuta*, *tuberosa*, and the rest of the cassids of which the spire shows the edge of previous lip varices, whereas the typical *testiculus* was included under the group designated as not showing this feature.

Incidentally, Linnaeus himself must have been familiar with the shell later called *crumena*, at least from pictures of it, as Buonanni's figure 161, which can be identified with *crumena*, immediately preceded figure 162, which Linnaeus cited for *testiculus*. Moreover, he actually cited this figure, 161, although in error, for *B. flammeum*.

The present species is now placed in the genus *Cypraecassis* Stuchbury, 1837, the type species of which is *Buccinum rufum* Linné. I know of no synonyms of *testiculus* other than *Buccinum plicatum* Dillwyn, although Bayer, 1935, gave the subspecific name *bicincta* to the form *crumena*.

The description of *testiculus* in the "Museum Ulricae" is, as is usual, more instructive by the addition of the phrases "absque nodis," "striae . . . numerosissimus," and "labium exterius reflexum, marginatum, extus atro maculatum." The Uppsala collection contains a specimen of *testiculus*, properly labeled.

The best figure of the species is found in Clench and Abbott (1943, pl. 2). In this plate figures 1, 2, and 3 show the typical form, and figure 4 shows a small example of the form *crumena*. The earliest figures are those of Martini [1773 (1769–1777), vol. 2, pl. 37, figs. 375–376] and are among the best figures in his work. They are accurate in every detail, except possibly of color pattern, although the species varies somewhat in this respect. An excellent black and white drawing is found in Crouch (1927, pl. 18, fig. 7a).

Buccinum decussatum

1758, *Systema naturae*, ed. 10, p. 736, no. 388.

1767, *Systema naturae*, ed. 12, p. 1199, no. 450.

¹ Concerning Linnaeus' frequent error when citing figures from Seba, the following quotation from Hanley's "Ipsa Linnaei conchylia" (*loc. cit.* in text) offers a possible explanation: "In quoting that work our author has continually annexed to the species he was defining the references also, which should have been attached to the adjacent one. I cannot help suspecting, then, that as his own library was not adorned with a copy of that costly publication, he had formed a list, when the opportunity occurred to him of consulting its pages, of all the species named by him there delineated, and has exhibited his usual carelessness of transcription in the distribution of figures." Although Linnaeus had "access" to a copy of Seba (see Hanley, 1855, p. 6), it seems certain that he did not own one even in 1767. The catalogue of the library of the Linnean Society of London (1925, new ed.) indicates this by the omission from the listing of the Seba work the sign "L" indicating that the volume came from Linnaeus' own library. As his library was acquired in its entirety by the Linnean Society along with his collections, this is, I think, sufficient proof.

LOCALITY: Not given in tenth edition; "in O. Africano" (1767).

"B. testa decussatim striata laevigata squamulis quadratis, apertura dentata, cauda recurva. . . . Labium interius punctis eminentibus notatum. Labium exterius interne crenatum."

Hanley (1855, p. 245) felt that the phrase "Labium interius punctis eminentibus notatum" was inapplicable to *decussatum*, but did fit the species *Phalium granulatum* (Born), 1780 (*Cassis abbreviata* Lamarck, 1822). The latter species has true granulations on the lower portion of the columella, while *decussatum* has only transverse ridges in this area, but these are so wavy and irregular that they, and particularly those shorter ones on the upper portion of the columella, might well have been described by Linnaeus as "punctis eminentibus." It is realized that this suggestion may be too emphatic a rationalization of Linnaeus' use of the phrase, but it is a possible explanation of it. Hanley also said that Linnaeus possessed both species and had confused them, but I cannot confirm this. No figure of *granulatum* was shown in the "Systema." Hanley, however, was apparently so convinced of the misuse of the phrase that he treated the description of *decussatum* as insufficient for identification and as referring to a different species, and confined the Linnaean name to the *decussatum* of the "Museum Ulricae."

I agree that the description is somewhat equivocal because of the quoted phrase, and that the diagnosis in the "Museum Ulricae," which is discussed below, more accurately describes the *decussatum* of authors, but see no justification for refusing to cite the species as of Linné, 1758. Linnaeus' synonymy in the "Systema" confirms this. Two of the three figures cited (Buonanni, pt. 3, pl. 157, and Gualtieri, pl. 40, fig. B), which are also cited in the "Museum Ulricae," are clearly based on *decussatum*. Moreover Linnaeus added a further good figure, "List. 1000," by a manuscript note in his own copy of the twelfth edition. The figure from Rondelet (1554-1555, pt. 2, p. 83, fig. 1, upper left-hand figure) "must be disregarded," according to Hanley (*loc. cit.*). However, with the exception of the fact that it is shown as a sinistral shell, a common fault with the early artists, it may well be taken for *decussatum*. The artist appears to have attempted to show the

decussate sculpture, and the shape of the shell is accurate.

A specimen of *decussatum* is in the Linnaean collection in London, and, although it is unmarked, it is the only specimen present which can be said to conform to Linnaeus' description. No specimen of *granulatum* is present.

The species is found with two radically different color forms, one with a spiral series of almost square spots of brown, and the other with a longitudinal series of wavy or zigzag brown lines. In both forms the color pattern often shows through the upper part of the parietal callus, if the latter is not too heavily deposited. Linnaeus, in the "Systema," described the spotted form, whereas in the "Museum Ulricae" he described the lined form in his added details by the phrase "Color albidus fasciis longitudinalibus flavis," although in the main description he copied the description of the spotted form in the "Systema." The possible defect in the "Systema" description in regard to the supposed granulations on the columella is entirely cured in the "Museum Ulricae" by the added phrase "Labium interius explanatum, postice [*sic*] tantum rugosum." This difference was the detail which troubled Hanley so unnecessarily.

In the Uppsala collection there has been an obvious mixture of specimens, as the shell now labeled for *Buccinum decussatum* is a much larger shell. The film shows only a dorsal view, but from this aspect it strongly resembles *B. galea*. On the scale shown on the film it is almost 6 inches in height.

The species is figured in Reeve (1843-1878, vol. 5, *Cassis*, pl. 2, figs. 4a, b, the spotted form, and figs. 4c, d, the lined form).¹

It is now included in the genus *Phalium* Link, 1807.

Buccinum areola

1758, *Systema naturae*, ed. 10, p. 736, no. 389.
1767, *Systema naturae*, ed. 12, p. 1199, no. 451.

¹ The confusion which Hanley attributed to Linnaeus, between *decussatum* and *granulatum*, may have been a real confusion in the mind of Lamarck. Although the latter listed the two species as distinct (1822, vol. 7, pp. 223 and 224, the latter as *Cassis abbreviata*), he cited for his *abbreviata* two of the undoubted figures of *decussatum* (Buonanni and Lister) which had been cited for the latter shell by Linnaeus.

LOCALITY: "In M. Mediterraneo" (1758); "in M. Mediterraneo, Java" (1767).

"B. testa substriata maculis quadratis quadrifariam cincta, apertura dentata, cauda recurva . . . Alia striata est, alia laevis. Labium exterius interiori margine dentatum est."

The description is identical in the tenth and twelfth editions. It contains so many equivocal phrases that it would have been difficult to identify the species without the aid of the almost completely accurate synonymy. The word "substriata" is deceptive, as the only sculpture consists of a few incised transverse lines at the base of the body whorl, which are so weak as to be easily overlooked, and are often wanting even in fresh specimens. Instead of the four rows of quadrate spots indicated by the word "quadri-farium," there are five, although the one nearest to the base is made up of smaller spots and is often incomplete. Moreover, the spots of the subsutural row are not quadrate but irregular in shape, and sinuous, and bent away from the direction of growth, and the spots in the two median rows are often crescent-shaped. As to color pattern Linnaeus was describing a specimen rather than a species. There is no mention of the single varix, which is a constant feature, of the thin but expanded parietal shield which usually overlaps the varix, the densely wrinkled columella, or the noticeable narrowing of the upper part of the body whorl. Some of these defects were cured in the manuscript notes for Linnaeus' proposed "revised edition," which were, however, never published. The useful words "Testa varicosa: col[umella] explan[ata] rugos[a]" were added to the description, and the inaccurate word "quadrifarium" was deleted.

The synonymy is, for the most part, accurate. The Rumphius figures (pl. 25, figs. 1 and B), from which the specific name was adopted, both Gualtieri figures (pl. 39, figs. G and H), although figure G has been criticized as having been meant for *Phalium saburon* (Bruguère), all three of the Seba figures (pl. 70, figs. 7-9), and the figure from Argenville (1742, pl. 18, fig. I) are unmistakably based on *areola* and are characteristic. Figure 2 from the Rumphius plate shows a shell decorated with unbroken longitudinal stripes and was probably based by Rumphius on a specimen of *Buccinum strigatum*

Gmelin, 1791 (*Cassis zebra* Lamarck, 1822). Lamarck, in this connection, said that his *zebra* (1822, vol. 7, p. 223) was very close to *areola* except that its color pattern was "differently disposed," and Dillwyn (1817, p. 593), who properly retained the Gmelin name *strigatum*, also compared it with *areola* Linné. Buonanni's figure 154, is, as usual, crude. It shows a shell with three transverse rows of small spots and may be taken for a stylized representation of *areola*. The same is true of Klein's figure (pl. 6, fig. 102) which is a mere copy of that of Buonanni. In summary, of the 11 figures, eight unquestionably show the *areola* of authors, two are probably based on that shell, and only one is of another species, a very good score for a Linnaean synonymy.

Hanley (1855, pp. 245-246) decided that the diagnosis of Linnaeus covered a composite species. He said, "As well from the synonymy and the widely remote localities, as from the expression 'Alia striata est, alia laevis,' it is manifest that Linnaeus confused more species than one under this appellation." This criticism of the synonymy has, I submit, been adequately answered above. As to the erroneous Mediterranean locality, this was either a slip on the part of Linnaeus, an error on the part of the supplier of the specimen, or, as several writers have claimed, was due to an honest confusion of *areola* and the Mediterranean cassid *Phalium saburon* (Bruguère).¹ I have already suggested, in the Foreword to these papers (Dodge, 1952, p. 9) that, in an age when most European collectors obtained their exotic material from sailors and other untrained travelers, the localities given were often erroneous. We know that Linnaeus had never visited the Far East, and I have seen no record of any visit by him to the Mediterranean. This is not the first case in which

¹ Lamarck (1822, vol. 7, p. 222) cited for *areola* Linné a figure from Lister (pl. 1012, fig. 76). Deshayes and Milne-Edwards [1844 (1835-1845), vol. 10, p. 27, vol. 10, p. 27, note] criticized this reference, saying: "Lister's shell has a short spire; it is transversely striate, and shows all the characters of a variety of *Cassis saburon*." This is mentioned to show that Lamarck also may have been confused by a fancied resemblance of *areola* to *saburon*. Indeed the Gualtieri figure G in Linnaeus' own synonymy was referred by Lamarck to *C. saburon*.

he gave a Mediterranean locality for an exotic species. In the tenth edition "Mediterranean" was the only locality given for *areola*. In the twelfth he added "Java." In any event, and although Davila, Gmelin, Dillwyn, and others repeated the error, it was soon corrected, as Lamarck (*tom. cit.*, p. 223) restricted *areola* to "l'Océan Indien et des Moluques," and I cannot find that the Mediterranean locality has been used since that time.

As to the words "Alia striata est, alia laevis," which were cited by Hanley as evidence that Linnaeus has confused *areola* with another species, probably *P. saburon*, I have already commented upon the fact that the basal striations, where present, are so weak and impermanent as to have justified the expression. I find Hanley's objections extremely captious. It may be that Linnaeus confused *areola* with *saburon*, but I doubt it. The evidence is too slight and is easily answered. In any case, later revisers restricted the diagnosis to the *areola* of authors, and from Lamarck onward this identification has been unequivocally accepted.

The present species is now included in the typical subgenus of *Phalium* Link, 1807 (*Bezoardica* Schumacher, 1817, and *Cassidea* Swainson, 1840, not *Cassidea* Bruguière, 1789).

A specimen of the *areola* of authors is present in the Linnaean collection in London. Its photograph in the microfilm shows no marking, and Hanley reported none.

In the "Museum Ulricae," while no locality was given, the apparent confusion with some longitudinally striped shell is also suggested. Not only did Linnaeus there cite the deceptive figure 2 from Rumphius, but in his expanded description he added the words "Variat color fasciis flavescentibus longitudinalibus repandis." Hanley (*loc. cit.*) cited these words, as well as the further phrase in the Museum Ulricae, "Variat labio interiore papilloso," as "evidence that our author's ideas of the comprehensiveness of this species were very latitudinarian." He concluded: "As these characters, however, were clearly intended for the varieties and not for the typical or more fully described form, naturalists have not improperly confined the name to the shell figured by

Rumphius (25, f. B, 1) from which the specific name was borrowed." As to the phrase "Variat labio interiore papilloso," it is true that the lower part of the columella in *areola* is rugose rather than papillose. It is possible that the use of this phrase in the "Museum Ulricae" indicates that Linnaeus had here confused *areola* with a third species, probably the western Atlantic *granulatum* Born, 1780. In this connection Martini, who supplied good figures of the *areola* of authors [1773 (1769–1777), vol. 2, pl. 34, figs. 355–356], also described and figured a shell for which he also cited *areola* Linné (*tom. cit.*, pl. 32, figs. 344–345), but which shows a papillose lower parietal lip and is unmistakably *granulatum*. These latter figures were selected by Clench (1944, p. 6) as the type figures for *granulatum* and were cited by Lamarck for his *Cassis granulosa*. There is much more evidence in the "Museum Ulricae," therefore, than in the "Systema" that Linnaeus confused two and possibly three shells. The description of *areola* in the "Museum" suggests not only *granulatum* but some longitudinally striped species, such as *strigatum*. This is another instance of the strange fact that Linnaeus sometimes changed his tenth-edition concept of a species in the "Museum Ulricae" and then reverted to the original description and concept in the twelfth edition.

The earliest figures of *areola* were the Martini figures cited above (figs. 355–356). It is also well figured in the "Tableau encyclopédique" (pl. 407, figs. 3a, b), and in Reeve (1843–1878, vol. 5, *Cassis*, pl. 9, sp. 24).

I am not aware that any other specific name has ever been given to this species.

Buccinum erinaceus

1758, *Systema naturae*, ed. 10, p. 736, no. 390.

1767, *Systema naturae*, ed. 12, p. 1199, no. 452.

LOCALITY: "In O. Americano" (1758); "in O. Americano, Alexandriae" (1767).

"B. testa subplicata papillis coronata, labro postico [*sic*] muricato."

Buccinum vibex

1758, *Systema naturae*, ed. 10, p. 737, no. 392.

1767, *Systema naturae*, ed. 12, p. 1200, no. 454.

LOCALITY: "Ad Jamaicam" (1758); "ad Jamaicam, Alexandriae" (1767).

"B. testa laevi tota, labro postico [*sic*] muricato."

The two above names are here treated together, not only because the two forms are so close and each is so variable, but because there has been, and still is, a difference of opinion as to whether the two are specifically distinct. It is today felt by many, and perhaps by the majority, of writers, that *erinaceus* is merely a form of *vibex* that differs from the typical form by the existence of certain characters, which, while they are visibly apparent, are not inherited or transmissible. On this basis, *erinaceus* may be called a phenotypic form of *vibex*.¹ Much further study is necessary, especially as to the anatomy of this complex and the habits of the two forms in the field, before it will be possible to determine the inheritability or transmissibility of their differing characters. For the moment I treat the two forms as conspecific. It should be noted, however, that the variations between typical examples of the two forms are so obvious, even though not constant, that one is tempted to suggest that they represent distinct species.

In *erinaceus* the body whorl is angulated into a shoulder just below the suture, and the shoulder bears a corona of tubercles, which are strongest near the outer lip and diminish in size and finally disappear towards the columellar side of the shell. These tubercles continue downward into short folds, which, in most specimens, are visible only on the upper third of the whorl. On the side of the whorl nearest to the outer lip the shell is strongly and closely wrinkled for its entire length. There is a great difference, however, in the number and prominence of the nodes and folds, and specimens are seen lacking, or almost lacking, both. In some individuals the whorls of the spire are more or less tuberculate. Lamarck (1822, vol. 7, p. 223) noted this in speaking of the "extended nodulations which are sometimes found on the later whorls."

The body whorl of *vibex*, on the other hand, as well as the spire, is normally completely

smooth, there being no trace of tubercles, folds, or wrinkles, and it is evenly rounded above and not angulate.

The color pattern of *vibex* consists of a number of zigzag or sinuous longitudinal brown lines on the body whorl, with an obscurely banded background ranging from flesh color to ashen, and the outer lip is decorated with a series of small, roughly quadrangular brown spots or dashes. In *erinaceus* the longitudinal lines are typically lacking, although some specimens show it. Both forms show the squarish spots on the lip, and in both the lower third of the lip bears four to six small but sharp denticles.

The Linnaean descriptions of these two forms, although short and lacking in many diagnostic details, are characteristic as far as they go. Together with the synonymy and together with Linnaeus' having placed them among the closely related *Phalium* species, they are sufficient to identify them. The synonymy of each is relatively good. For *erinaceus* the following figures are characteristic: Rumphius (pl. 25, fig. 7), Gualtieri (pl. 39, figs. I, D), Argenville (1742, pl. 17, fig. G), and Seba (pl. 53, figs. 11-14, 16). Seba's figure 15 resembles the form *crumena* of *Buccinum testiculus*. For *vibex* Rumphius (pl. 28, figs. 8-9), Gualtieri (pl. 39, fig. F), Seba (pl. 53, figs. 3-4), and Regenfuss (pl. 10, fig. 40) are evidently based on *vibex*. Gualtieri's other figure (pl. 39, fig. L) shows a columella so twisted that it resembles the closely related *turgida* Reeve. Seba's remaining figures (pl. 53, figs. 5-7) show traces of tubercles on the shoulder. Specimens of *vibex* are found which simulate *erinaceus* in this respect, and therefore these figures may not be dismissed as badly chosen, although Linnaeus' description does not cover this variability. The Buonanni figure (pl. 152) is obviously *erinaceus*, although it may have been a mistake in transcription for plate 151, which is clearly *vibex*. Argenville's figure (1742, pl. 17, fig. H) is apparently *vibex*, although it bears a varix on the dorsum, a feature that the present writer has not seen in that form.

Linnaeus' locality for *erinaceus*, "O. Americano, Alexandriae," and for *vibex*, "Ad Jamaica, Alexandriae," are both erroneous. Both names represent well-known Indo-Pacific forms. They have, however, been

¹ In the science of genetics, genotype is the class into which an individual falls on the basis of its genetic constitution without regard to visible characters. Phenotype, on the other hand, is "the class into which an individual falls on the basis of visible characters as the result of an interaction between genotype and environment" (after Mayr, Linsley, and Usinger, 1953, pp. 306, 311).

several times reported from the western Atlantic. Clench (1937, p. 61) mentioned *vibex* as one of the few Indo-Pacific species that have been reported from the western Atlantic, and a year later (1938, p. 112) the same writer reported taking a single specimen of *vibex*, alive, in Puerto Sosua, Santo Domingo. Patterson (1944, p. 38), in a paper on collecting in the Bahamas, reported two specimens of "*vibex*." In a third paper Clench (1944, pp. 2-3) recognized that the specimens so reported were not of the Indo-Pacific shell but represented a new species which he named *atlantica* and placed in the genus *Casmaria* H. and A. Adams, 1853, a generic name that covers all specimens of "*vibex*" or "*erinaceus*" reported from this region as well as the true *vibex* and *erinaceus* of the Indo-Pacific. He also reported new finds of *atlantica* from the Florida Keys, Hispaniola, and the Bahamas.

Linnaeus' other locality for both was "Alexandriae." I have not been able to substantiate this. Stearns (1894, p. 348) had reported *vibex* from as far east as the Gulf of California.

Gmelin partially corrected the locality by adding "et Indico" to Linnaeus' incorrect location. Lamarck (1822, vol. 7, p. 228) located *vibex* only in the Mediterranean "près de l'Egypte," but in his diagnosis of *erinaceus* (*tom. cit.*, p. 229) he modified this by saying, "Habite les mers d'Inde comme probablement le précédent." Reeve (1843-1878, vol. 5, *Cassis*) treated *erinaceus* as a variety of *vibex*, and synonymized it with *Cassidea erinaceus* Bruguière, 1792, *Buccinum nodulosum* Gmelin, 1791, *Buccinum biarmatum* Dillwyn, 1817, and *Cassis erinaceus* Lamarck. His figures of *vibex* (pl. 7, sp. 15b, c, d) show two shells which are entirely smooth and one which shows nodes and folds on the body whorl. In these figures, as well as in his text, he recognized that the possession of sculpture is not exclusively the characteristic of *erinaceus*. His figure of *erinaceus*, which he called "variety β of *vibex*" (fig. 15a), is of a slightly nodose shell with an extremely callous columella and parietal area. There appears to be no twist to the columella in the figures of either form, and each shows four (or five?) sharp denticles at the lower end of the lip edge.

Although the so-called "typical" forms of the two shells show radical differences in size, shape, sculpture, and coloration, each is variable. The difficulty in identifying a given specimen at first glance lies in the fact that many specimens of each show, to a limited extent, characters normally associated with the other, a fact that is reflected in the various descriptions and figures in the literature. One might almost establish a chain of intermediates between the two.

Hanley followed Reeve in treating *vibex* as the good species with *erinaceus* as a variety (1855, pp. 246-247). Tryon (1879-1888, vol. 7, p. 277) on the other hand listed them both as good species, describing the "typical" forms for each. Thus, to him, *vibex* was larger, entirely smooth, with longitudinal wavy lines of chestnut, while *erinaceus* was smaller, with a tuberculate shoulder and plications extending below them.

The identification is complicated further by the existence of two other species, *turgida* Reeve (1843-1878, vol. 5, *Cassis*, pl. 10, sp. 25a, b, c) and *torquata* Reeve (pl. 1, sp. 1a, b, c). These are both very close to the complex here discussed and both have at times been confused with either *vibex* or *erinaceus*. *Cassis turgida* is a smaller, more swollen shell than either. Its most marked distinguishing character is its extremely twisted columella, which is in contrast to the columella of both *vibex* and *erinaceus*, in which the twisting is less extreme. Moreover, its outer lip bears sharp denticles for its entire length. It is entirely smooth. The other, *C. torquata*, is principally distinguished by its color pattern of two rows of squarish dark brown spots, one just below the suture and another near the base of the shell. Its columella is not twisted but bears a number of fine plaits. It possesses denticles for the full length of the outer lip, as does *turgida*. It is devoid of sculpture. It is not understood why Reeve gave the name *torquata* to this shell rather than to the other.

I am treating *erinaceus* as a form of *vibex* with some diffidence, as there is a respectable body of opinion today that they represent distinct species.

The two species or forms are now included in the genus *Casmaria* H. and A. Adams, 1853, *vibex* being the type species, by sub-

sequent designation, Harris, 1897. *Casmaria* is, in part, equal to *Cassidea* Swainson, 1840, not *Cassidea* Bruguière, 1792, nor *Cassidea* Link, 1807.

Specimens of both *vibex* and *erinaceus* are found in the Linnaean collection in London, each being properly marked by Linnaeus.

Both forms are described in the "Museum Ulricae," and the expanded descriptions in that work not only fix the names for the "typical" forms more definitely than the descriptions in the "Systema," but, in the case of *vibex*, take account of the variability of the shell. The phrase "tota laevi" is copied from the tenth-edition description, but is modified in the subdescription in the "Museum" by the phrase "rarius cincta antice [sic] nodis oblitteratis." For *erinaceus* the description of the shoulder nodes is amplified by the following, "a quibus posteriora versus sulci elevati ducunt."

Buccinum glaucum

1758, *Systema naturae*, ed. 10, p. 737, no. 391.

1767, *Systema naturae*, ed. 12, p. 1200, no. 453.

LOCALITY: "In O. Asiatico" (1758, 1767).

"B. testa laevi papillisque coronata, labro postice muricato."

The description is identical in the tenth and twelfth editions.

The characteristic but brief description, the clearly identifiable figures in the synonymy (Rumphius, pl. 25, fig. A; Gualtieri, pl. 40, fig. A; and Seba, pl. 71, figs. 11, 12, 14, 16), and the presence in the Linnaean collection in London of a specimen of the *Phalium glaucum* of substantially all later authors, which is the only specimen in the collection conforming to the description, have identified the species beyond question. On the same plate of Seba the intermediate figures 13 and 15, not cited by Linnaeus, were considered by Hanley (1855, p. 247) to be based on *Cassis coronulata* Sowerby, 1825. I cannot identify these two figures with as much assurance as Hanley did, but at least they do not show *glaucum*, and Linnaeus' choice of figures was correct. An additional accurate figure (Lister, pl. 996, fig. 60) was added to the synonymy by a manuscript note in Linnaeus' own copy of the twelfth edition.

The description in the "Museum Ulricae" adds, as usual, several confirmatory details, such as the yellow-brown color of the aper-

ture, the dentition of the inner face of the outer lip, the papillose sculpture of the whorls of the spire, and the coronation of its last whorl.

It should be noted that Linnaeus has again confused the two ends of the shell, as he said in the "Systema" "labro postice muricato," whereas the denticulations are at the anterior end of the lip.

Three specimens of the *glaucum* of authors are in the Uppsala collection, properly labeled.

Buccinum glaucum is now placed in the genus *Phalium* Link, 1807, and is the type species, by subsequent designation, Dall, 1909. Prior to the ruling as to the questionable character of most of the Martini and Chemnitz generic names, a number of workers used *Cassis* as of Martini, 1771, instead of Scopoli, 1777. The type species of *Cassis* Martini is *B. glaucum* Linné, by subsequent designation, Children, 1823. The adoption of *Cassis* Martini would therefore make *Phalium* Link an exact synonym, as they have the same type species, *Buccinum glaucum*.

The species is figured in Reeve (1843-1878, vol. 5, *Cassis*, pl. 12, sp. 33). It is not figured in the "Tableau encyclopédique."

Synonyms are: *Buccinum galea-ferrea* Martyn, 1786, *Cassida bezoar* Humphrey, "Museum Calonnianum," 1797, *Bezoardica vulgaris* Schumacher, 1817, and *Cassida strigata* Shirley, 1911.

Buccinum papillosum

1758, *Systema naturae*, ed. 10, p. 737, no. 393.

1767, *Systema naturae*, ed. 12, p. 1200, no. 455.

LOCALITY: "In O. Asiatico" (1758, 1767).

"B. testa undique tuberculata, labro postice muricato."

The description is identical in the tenth and twelfth editions.

As this is the first species of *Nassarius* to be considered, the circumstances of its erection should be noted. The name was first used by Duméril in 1806 in his "Zoologie analytique" (p. 166). It was, however, a genus without species. Later in 1806 Froriep translated Duméril's work into German and listed a single species, *N. arcularia*, the *Buccinum arcularia* of Linnaeus, which is therefore the type species of the genus, by monotypy.

The description of the present species,

read in connection with the specific name *papillosum*, is amply sufficient to identify it, as it points out two of the principal characteristics of the shell, the tubercles covering the entire exterior and the small but extremely sharp denticulations seen at the anterior end of the lip. Moreover, it is the only one of the *Nassarius* species included in *Buccinum* Linné that can be so described. It should be noted, however, that again Linnaeus has mistaken the orientation of the shell, as he used the phrase "labro postice muricato." The labial teeth are usually six in number, and the lowest two are ordinarily partly coalesced into what appears to be a bifid tooth. By a manuscript note in his own copy of the twelfth edition he referred to a diagnostic feature of all of his seven species of *Nassarius* beginning with *papillosum*: "455-461 in fauce seu columella superne dens unus." This omits the Linnaean species *Buccinum reticulatum*, which, although a *Nassarius*, is not grouped with them and lacks the upper columellar tooth, as do many of the *Nassarius* species since described.

The synonymy in the "Systema" is unusually accurate, all the figures cited (Rumphius, pl. 29, fig. M; Argenville, 1742, pl. 12, fig. I; and Seba, pl. 49, figs. 57-59) clearly showing this easily recognizable species. A further good figure (Gualtieri, pl. 44, fig. G) was added by a manuscript note, which also reported a more definite locality, "Java."

A properly marked specimen of the species is found in the Linnaean collection in London. The description in the "Museum Ulricae" adds confirmatory details: the color is given as "pallidus s. albus"; the spire is accurately described as being longer than the rest of the shell; the aperture is correctly described as "subrotunda, laevis, glabra, interne parum striata"; and the deep sinus at the base is mentioned. The description is, however, faulty in some respects: there are said to be eight rows of tubercles, whereas in almost all specimens seen by the present writer there are only seven. Very rarely there is an eighth row at the base of the shell consisting of very small and almost imperceptible tubercles. They are described as being arranged in a quincunx pattern, whereas each is placed exactly in a vertical line with those above and below it. The phrase "cauda reflexa ad latus" is not under-

stood, as the word "cauda" is ill employed in species of this genus, which have little discernible "tail," such as is seen in the cassids and certain murices. There is no mention of the markedly pink color of the apex of the spire, a feature that Linnaeus often referred to. A specimen of the *papillosum* of authors, properly labeled, is in the Uppsala collection.

The species is placed in the genus *Nassarius* Duméril, 1806, although many European writers have preserved Lamarck's *Nassa* for this shell and its congeners. Thiele (1931, p. 325) uses *Nassa* Lamarck, placing *papillosum* in the subgenus *Alectryon* Montfort, 1810 (*Alectrion*). *Alectrion* and *Nassa* Lamarck, 1799, not Röding, 1798, are considered by many writers to be exact synonyms of *Nassarius*.

Nassarius papillosus is figured by Reeve (1843-1878, vol. 8, *Nassa*, pl. 2, sp. 12). The *Buccinum papillosum* of the "Liste" is credited to Lamarck, and is figured in the "Tableau encyclopédique" (pl. 400, figs. 2a, b). These latter figures are curious, as the tubercles are shown as connected by sharp and elevated longitudinal ridges both on the body whorl and on the spire, which do not exist in *papillosus*. Two early figures in Chemnitz (1780-1795, vol. 4, pl. 125, figs. 1204-1205) are characteristic. They show the pink apex of the spire, which was omitted in some of the later colored plates.

Buccinum glans

1758, *Systema naturae*, ed. 10, p. 737, no. 394.

1767, *Systema naturae*, ed. 12, p. 1200, no. 456.

LOCALITY: "In O. Asiatico" (1758, 1767).

"B. testa laevi, labro postice muricato, labioque interiore bidentato."

The description of this species, which is identical in the tenth and twelfth editions, has several weaknesses. First we must correct Linnaeus' frequent error in confusing the anterior and posterior ends of the shell. The confusing expression "labioque interiore bidentata" must be explained; there is only one "tooth" in the aperture of *glans*, a small protuberance at the posterior end of the parietal wall, unless Linnaeus, for the second tooth, was referring to a projection at the base of the columella, although the latter is merely an angle of the base. Further, there is no mention of the striking color

pattern of the shell, the characteristic series of thin, equally spaced brown lines encircling the body whorl and the lower two whorls of the spire, nor of the fulvous blotches of the background. The papillose sculpture of the second to fifth whorls of the spire is not noted. In the last analysis it is a very uninformative description.

In the "Museum Ulricae" the word "postice" is retained and the "teeth" are again mentioned as "denticulo ad basin et apicem," thus confirming that Linnaeus saw the lower columellar projection as a tooth. The description does, however, correct one of the defects in the "Systema"; the color pattern is described as "pallidus lineis parallelis fuscis s. rubris, nebula fulva in dorso." The other added amplifications of the "Systema" description are also confirmatory of the identification of the species with the *glans* of authors, with the exception of the equivocal description of the spire as "Spirae apex longitudinaliter sulcatus." The sulci of the spire are both spiral and longitudinal, giving it a decussately papillose appearance.

The presence in the London collection of a marked specimen of the *glans* of authors completely confirms the accepted identification.

The several figures cited (Rumphius, pl. 29, fig. P; Seba, pl. 39, figs. 56, 57, 60) are all recognizably *glans*. The Seba drawings were cited only in the twelfth edition and did not appear in the "Museum Ulricae." Further amplification of the two descriptions is provided by a manuscript note in Linnaeus' own copy of the twelfth edition: "Albida, cincta lineis testaceis; col[umella] adglutin[ata] imperf[orata]. Faux unidentata." Thus Linnaeus finally recognized that there was only one "tooth" in the aperture.

The variety mentioned in the "Museum Ulricae," "tota atra labio crasso," is not recognized. Hanley (1855, p. 248) suggested that it might be the *Buccinum olivaceum* of Bruguière, 1789, but that species is too remote from *glans* to be referred to it even as a variety. It is said by Lamarck (1822, vol. 7, p. 267) to be native to the "Seas of the Antilles." I know of no western Atlantic *Nassarius* that conforms to its description.

The species *glans* is included in the genus *Nassarius* Duméril, 1806. *Nassa* Lamarck,

1799, is a synonym only in part, as it covered only those species having a highly developed parietal shield or, at least, a columellar callus. *Tritia* Risso, 1826, is an exact synonym, as is *Arcularia* Link, 1807.

It is figured in Reeve (1843-1878, vol. 5, *Nassa*, pl. 1, sp. 5). Chemnitz' early figures (1780-1795, vol. 4, pl. 125, figs. 1196-1200), while somewhat stylized, are as accurate portrayals of the characteristics of the species as have been published. Kiener (1834-1850, vol. 9, pl. 15, fig. 52, dorsal and ventral aspects) supplied a characteristic pair of figures of this easily recognizable species.

Buccinum arcularia

1758, *Systema naturae*, ed. 10, p. 737, no. 395.

1767, *Systema naturae*, ed. 12, p. 1200, no. 457.

LOCALITY: Not given in 1758. "Ad Javam" (1767).

"B. testa plicata papillisque coronata, labio interiore explanato gibbo."

Buccinum pullus

1758, *Systema naturae*, ed. 10, p. 737, no. 396.

1767, *Systema naturae*, ed. 12, p. 1201, no. 458.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa gibba oblique striata, labio interiore explanato gibbo . . . Praecedenti dimidio minor, ferruginea, striis longitudinalibus, sed obliquis et fascia transversa alba."

The two above species are considered together because of the confusion that has existed as to the interpretation of their descriptions. Many unrevised collections contain undoubted specimens of *arcularia* labeled *pullus*, in spite of the striking difference in the two descriptions. The problem also involves the *B. thersites* of Bruguière, 1789.

The description of *arcularia* seems to point clearly to the Indo-Pacific *arcularia* of authors. The combination of the word "plicata" with the phrase "papillisque coronata" and the mention of the expanded callus of the parietal area are sufficient to distinguish the species not only from *pullus* but from any other of the Linnaean nassarids. The synonymy is, with one exception, characteristic. The figure from Rumphius (pl. 27, fig. M), one of the two Gualtieri figures (pl. 44, fig. O), the Argenville figure (1742, pl. 17, fig. C), and the two figures from Seba (pl. 53, figs. 32-33) are unquestionably, though in the

case of Rumphius only probably, based on *arcularia*. Only the remaining Gualtieri figure (pl. 44, fig. R) is really doubtful. A further accurate figure from Lister (pl. 970, fig. 24) was later added to the synonymy by a manuscript note of Linnaeus in his copy of the twelfth edition. He also added, in another manuscript note, the following words to the description: "Faux unidentata, striata lab[ium] ext[erius] postice subdentatum." This note, while never published and therefore without authority as defining the species, is to some extent confirmatory of the identification arrived at from the published description. It is not, however, entirely clear. The species has pointed extensions of the outer lip at *both* the posterior and anterior ends, a callous knob at the posterior end of the parietal shield, which is sometimes so sharp as to justify the name of tooth, and a sharp ridge at the base of the columella and extending into the aperture. This, when viewed from the front, simulates a "tooth." It is not clear just which two of these features were meant by Linnaeus' note.

Gmelin's description of *arcularia* (1791, p. 3480) lists five varieties. For the typical variety he cited many of the figures cited by Linnaeus, and added others. The other four varieties are not identifiable from their synonymies. Martini's figure (1769-1777, vol. 2, pl. 41, fig. 413), cited for variety " β ," resembles *B. gibbosulum*, which both Martini and Gmelin listed separately.

Lamarck (1822, vol. 7, p. 276) confined the species to a typical form and a variety "[b]." Based on the synonymy supplied for this variety, Deshayes and Milne-Edwards (1835-1845, vol. 10, pp. 178-179, footnote) elevated it to the rank of a good species, which they called *Buccinum rumphii*. Dillwyn (1817, p. 604) referred Gmelin's variety " β " to *B. thersites* Bruguière, 1789, a quite different species, which I am identifying with *B. pullus* Linné (see below).

A marked specimen of *B. arcularia* is found in the Linnaean collection in London and is therefore to be considered as Linnaeus' type specimen.

In the "Museum Ulricae" the species was listed and the description amplified, but only the following added details need be noted: "Color albus" must mean that the

specimen in the Queen's collection was worn and faded. "Apertura . . . intus striata, alba" is equivocal. The aperture of the *arcularia* of authors has so many almost, if not quite, coalescing brown striations, with one broader white band, that it appears brown rather than white. The phrase covering the lip, "Labium exterius simplex . . . sed utraque extremitate definens denticulo," amplifies and clarifies Linnaeus' manuscript note in the "Systema naturae" by adding a reference to the tooth-like process at the *anterior* end of the lip. A correctly labeled specimen of *arcularia* is in the Uppsala collection. A specimen of *B. coronatum* Bruguière, 1789, is also present, properly labeled. This seems a distinct species, distinguishable from *arcularia* by the marked restriction of its parietal callus as compared with the widely flaring shield of that species, and by the fact that it is higher in proportion to its width and has a higher spire. Moreover, aside from a nodular coronation and a few basal spiral striations, its body whorl lacks any sculpture. This lack is constant in all specimens examined, whereas most specimens of *arcularia* show longitudinal rugae descending from the shoulder nodes over a greater or less extent of the whorl. These distinguishing features are clearly brought out in Lamarck's description (1822, vol. 7, p. 276). Dr. Odhner, who supervised the preparation of the microfilm of the collection and prepared the annotated list accompanying it, is of the opinion that the features of *coronatum* are included in the diagnosis of *arcularia* in the "Museum Ulricae," but I am unable to point to language substantiating this. The film shows only a dorsal view of *coronatum*, so that the extent of the parietal callus is not visible. The dorsum is smooth in the picture.

The species belongs in the genus *Nassarius* Duméril, 1806, of which it is the type species, by monotypy.

The main description of *Buccinum pullus* contains only one phrase, "oblique striata," which distinguishes it from *arcularia*, but the subdescription uses language so diametrically opposed to the appearance of that species that it seems impossible that the two could ever have been confounded. "Praecedenti dimidio minor" seems to have been lost sight of by those who have mislabeled specimens of

this shell in collections. It certainly cannot be disregarded. Also the mention of the oblique striations is repeated in the subdescription.

The synonymy is not helpful. It is rightly said by Hanley (1855, p. 249) to be "an erroneous multiplicity of conflicting delineations," and Hanley adds, "it is not surprising that very different looking *Nassae* should have been designated by the same appellation in the works of various authors, so that it really becomes difficult to say what is the modern received notion of the Linnaean species."

The reference to Lister (pl. 970, figs. 25-26) was properly changed to plate 971, to which figure 26 belonged, by a manuscript note. That figure is too crude to be identified. Of the two Gualtieri figures (pl. 44, figs. M, N), the first shows a decidedly gibbous dorsum but is otherwise unidentifiable. Figure N is too vague to be identified. On the same plate of Gualtieri figure L, which was not used by Linnaeus, is a recognizable figure of the *thersites* of Bruguière.

The figure from Adanson (pl. 8, fig. 11, two figures), which the author called "le Totombo," has been the subject of considerable discussion. It shows the sculpture of a young *thersites*, but the dorsal view shows no trace of any gibbosity. Adanson cited for his species the good Gualtieri figure L and also the two other figures from the same plate that Linnaeus cited, and the bad Lister figure (pl. 970 [971], fig. 26). Fischer-Piette and his co-authors (1942, p. 214), in their study of the retained Adanson collection (see Dodge, 1955, introduction to *Voluta*, p. 53), has, I submit, settled the question of the identity of Adanson's species. They said "The ancient authors Linné, Gmelin, Bruguière, Lamarck, Bosc, united the Totombo with *Buccinum pullus* L.; since then there has been no doubt, to our knowledge, about this Adanson species." Fischer-Piette and his collaborators found in the collection a box containing traces of glue corresponding to the impression of four shells, the box being marked "2431, *Purpura* 11 Totombo, Hist. Nat. du Séné. pl. 8." A shell was present, having the appearance of Totombo, and bearing a trace of glue which fitted exactly into one of the beds of glue in the box. They added: "This shell, which is not the specimen figured, . . .

is the species *Nassa stigmara* Adams." *Nassa stigmara* is an Indo-Pacific shell. Adanson had four specimens of Totombo, as shown above, one of which was apparently a juvenile shell. Fischer-Piette and his co-authors reasoned that they were collected in Senegal. On this point they said: "... although he does not mention the animal, it would be reasonable to think that he found this species in Senegal. This case is confusing, but we would not be the first to trust to the localities given by Tryon for other *Nassa* species, *N. gaudiosa*, *N. picta*, *N. tritoniforma*, which live in the Indo-Pacific and also in West Africa." This reasoning is not so unanswerable as one would wish, but it is certain, at least, that Adanson had a specimen of *stigmara* on which he probably based Totombo, and the weight of evidence is that it was collected in Senegal. Why the artist employed should have figured another species, which is unidentifiable, is unexplainable.

We are left, then, with a synonymy of *pullus* Linné that has not a single figure showing *arcularia* and, indeed, only one that is identifiable, and that one shows *thersites* Bruguière.

Disregarding this heterogeneous synonymy, as we must, we find that the description, standing alone, strongly suggests the shell later called *Buccinum thersites* by Bruguière in 1789. That species is approximately half of the size of *arcularia*, and its striations are somewhat more oblique than are those in *arcularia*. It also possesses the white band around the body whorl, which was mentioned for *pullus*. The most significant detail is that *pullus* is defined as "gibba," a word omitted from the description of *arcularia* except as applied to the parietal callus. The body whorl of *thersites* is markedly gibbous dorsally, and this gibbosity is particularly emphasized by a prominent knob or hump near the top of the whorl midway between the two lips of the shell. This identification is confirmed by the presence in the Linnaean collection in London of a specimen of the *thersites* of authors, which is the only specimen in the cabinet that answers to the description of *pullus*. The specimen is in a box containing also a specimen of *B. gibbosulum* Linné, the succeeding species, but the box is marked with the names of both *pullus* and

gibbosulum. There is no doubt as to which shell was the type of Linnaeus' *pullus*, as the two are radically different in appearance, *gibbosulum* being devoid of all sculpture, whereas *pullus* is a rather deeply striate shell. Although it can be said that the name *thersites* is fairly firmly entrenched in the literature, I would strongly recommend the restoration of the Linnaean name *pullus* for the species. Not only was it substituted for *pullus* by a demonstrable error of Bruguière, but the allocation of the name *pullus* to the smaller species will help to set at rest the long-continued confusion between *pullus* and *arcularia*.

Linnaeus' failure to mention the dorsal hump specifically in his description of *pullus* should not impugn this identification. If a Linnaean description is to be condemned for a failure to elaborate a diagnostic feature, few of his descriptions would be left as acceptable. In the present instance the failure does not seem important, in the light of the use of the word "gibba" as applied to the shell itself. That word undoubtedly refers to the general contour of the dorsum, including the hump. This might be termed a rationalization, but, I suggest, merits consideration.

As an example of the tendency of authors to associate *pullus* with *arcularia* rather than with *thersites*, the categorical words of Tryon (1879-1888, vol. 4, p. 24, pl. 7, figs. 12-14) may be cited. After listing *N. pulla*, apparently as a good species with varieties, he said "That *N. pulla* is itself identical with *N. arcularia* is demonstrable from the series of specimens before me." He gave the size of *pulla* as "1-1.35 inches," which corresponds to the height of the largest forms of *arcularia*. The figures he supplied are clearly *arcularia*. He listed *thersites* Bruguière separately (p. 25), for which he noted the dorsal gibbosity and the limited area covered by the longitudinal striations, as follows: "Ribs usually obsolete on the mouth side of the dorsal hump." He gave the size of *thersites* correctly as ".6-.85 inch," and apparently did not realize that this small size, together with the presence of the dorsal hump, conformed to Linnaeus' description of *pullus*. Certainly the greatest fault of workers dealing with the Linnaean species has been their failure to read carefully the original descriptions. Kiener (1834-1850,

vol. 9, pp. 97-98, pl. 28, fig. 112), in his discussion of *N. pulla* may also be quoted: "I think that this shell is a variety of *Buccinum arcularia*. The plications and striations cannot be considered as constant characters, and belong only to young individuals." His figures of both *pullas* and *coronatum* Bruguière show forms of *arcularia*.

Linnaeus' locality for *pullus*, "M. Mediterraneo," was erroneous, as the species is native to the Indo-Pacific region.

Buccinum pullus is not described in the "Museum Ulricae," and no specimen is present in the Uppsala collection.

It is not *B. pullum* Born, 1780, which was probably based on the young *B. rufum* Linnè, nor the *B. pullus* of Pennant, 1812, which was probably identical with *B. ambiguum* of Pulteney, Montagu, Maton and Racket, and Dillwyn, and *B. vulgatum* Gmelin, both of which names refer to the juvenile shell of *B. reticulatum* Linnè (see p. 215, below).

Buccinum pullus, which is now contained in the genus *Nassarius* Duméril, 1806, is well figured in Reeve (1843-1878, vol. 8, *Nassa*, pl. 10, sp. 65, as *Nassa thersites*). His figure entitled *Nassa pulla* (pl. 4, sp. 22) is definitely *arcularia*. It is also figured in the "Tableau encyclopédique" (pl. 394, figs. 8a, b), being called *N. thersites* in the "Liste."

Buccinum gibbosulum

1758, *Systema naturae*, ed. 10, p. 737, no. 397.

1767, *Systema naturae*, ed. 12, p. 1201, no. 459.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa gibba laevi, labio interiore explanato gibbo."

The description, which is identical in the tenth and twelfth editions of the "Systema," would be inadequate, standing alone, to identify the species were it not for the significance of its position immediately following *arcularia* and *pullus*, the other two species having expanded calluses around the aperture. The description differs from the main description of *pullus* only in the use of the word "laevi" instead of "oblique striata," but this is sufficient to distinguish it from the other two. The situation in the Linnaean collection in London is mentioned under the preceding species. A box is present containing specimens of *gibbosulum* and *pullus*. The box is marked for both species, however, and the

two are so different in sculpture that there is no doubt that the two specimens are respectively the types of the two species involved. The Linnaean description of *gibbosulum* cannot be applied to *pullus* (*thersites* Bruguière). A manuscript note by Linnaeus, written in his copy of the twelfth edition, added the words "Faux unidentata[ta] laevi[s]," and is further confirmation of the identification.

The eversion of the outer lip and the parietal callus in adult specimens of *gibbosulum* give the shell somewhat the appearance of one of the small margined *Cypraea* species when it is viewed dorsally. The species has also a more or less prominent callous knob at the posterior end of the parietal callus to the left of the posterior canal. In some forms the everted outer and inner lip is margined by a deep orange line on the side away from the aperture. The color of the shell is ordinarily yellowish or ashen, variously banded, freckled, or blotched with white or a dark color. The callus is pure white, although in young specimens the dark color often shows through at its posterior end. *Nassa circumcincta* A. Adams, 1851, was based, according to Tryon, on specimens showing the orange marginal line behind the inner and outer lips.

Linnaeus' synonymy for the species in the tenth edition of the "Systema" consisted of a single figure (Gualtieri, pl. 44, fig. L). This, although badly drawn, has been generally accepted, and probably rightly, as showing the *gibbosulum* of authors. The Seba figure added in the twelfth edition (pl. 53, fig. 46), according to Hanley (1855, p. 250), "most decidedly represents *Thersites*, and was either misplaced, or, being a dorsal view only, mistaken for the other." I agree that the figure is one of *thersites* (*pullus* Linné), but it must have been cited in error, as Linnaeus could hardly have confused the smooth dorsum of *gibbosulum* with the striated back of the other shell.

The species is so easily distinguishable from the other Linnaean nassarids, and is so plentiful in its range, that its nomenclatorial history has been uneventful. It is included in the genus *Nassarius* Duméril, 1806, and is usually placed in the subgenus *Arcularia* Link, 1807, Thiele citing it as the type species of the typical section of the subgenus.

It is figured in Reeve (1843-1878, vol. 8, *Nassa*, pl. 10, sp. 64a, b), and in Tryon

(1879-1888, vol. 4, *Nassa*, p. 24, pl. 7, figs. 15-17).

Buccinum mutabile

1758, *Systema naturae*, ed. 10, p. 738, no. 398.

1767, *Systema naturae*, ed. 12, p. 1201, no. 460.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa laevi: adultiore rugosa, spira exserta, labio interiore subexplanato . . . Testa Tenera, laevis, pallida, anfractibus margine superiore obsolete albis rufisque. Spira exquisita anfractibus distinctissimis, longitudine testae. Adultior vero longitudinaliter rugosa evadit, cinerea, opaca; labium interius antice extenditur crassiusculum."

The description is identical in the tenth and twelfth editions except for the insertion of a semicolon after "opaca" in the twelfth edition subdescription in place of the word "et."

The combination of a fairly clear description, the Mediterranean locality, and the conformity of the sole figure cited (Gualtieri, pl. 44, fig. B), which is clearly the *mutabile* of all authors, insured the early identification of this species. The phrase "adultiore rugosa" is, however, misleading. The rugae referred to may have been the irregularities seen near the outer lip, which are mere crowded growth lines, or the slight nodosity at the shoulder of each whorl in some forms of the shell. That Linnaeus meant only that the upper whorls of the spire were rugose was apparently accepted by Chemnitz (1780-1795, vol. 11, p. 89, pl. 188, figs. 1810-1811), who used the expression "apice longitudinaliter striato." Even this phrase is misleading, as the upper whorls of the spire of *mutabile* are nodose rather than striated. Lamarck (1822, vol. 7, pp. 269-270) used the phrase "superne longitudinaliter plicata," which is equally deceptive. Lamarck also referred to the growth lines mentioned above by saying, "It has a few longitudinal rugosities on the outside of its lip."

A specimen of the *mutabile* of authors is present in the Linnaean collection in London, and, as it is the only shell present which conforms to the description, it was probably Linnaeus' type.

Among the early writers only Born (1780, p. 252, pl. 9, fig. 13) and Dillwyn (1817, pp. 602, 605-606) failed to evaluate the species correctly. Born's *mutabile*, based on his description, his synonymy, and his figure, is not the *mutabile* of Linnaeus. In his synonymy he

cites two fair figures of that shell and one pair of figures from Chemnitz (1780–1795, vol. 4, pl. 125, figs. 1194–1195) which resemble the shell later described by Lamarck as *Buccinum canaliculatum* (1822, vol. 7, p. 267). His own figure, which does not conform to his description, shows a shell close to *canaliculatum* Lamarck, but which has simple and not *canaliculate* sutures. Dillwyn listed *mutabile* Linné (p. 605), referring it both to the *mutabile* of the "Systema" and of Born, and citing the two good Chemnitz figures mentioned above (pl. 188, figs. 1810–1811), which he called "Variety, with a spotted band near the suture." The latter is the true *mutabile* of Linnaeus. He also listed separately *Buccinum gibbum* Bruguière (1789, p. 267), for which he referred to several figures, including the Gualtieri figure correctly cited for *mutabile* by Linnaeus, but did not associate *gibbum* in any way with the Linnaean species. I consider this to be error, as *gibbum* is, in my opinion, an exact synonym of *mutabile* Linné. Dillwyn said of his *mutabile* (p. 606): "Almost all authors have disagreed respecting *B. mutabile*, and Bruguière with much probability has conjectured that Linnaeus, supposing *B. gibbum* to differ from the present shell only in age, used the name to express such a remarkable change in appearance. The shell [*mutabile*] . . . is said by Bruguière to be uniform without any markings; Chemnitz has, however, figured a shell which agrees in all other respects with this species, but which resembles *B. gibbum* in being freckled, and in having a similar white spotted band at the suture. . . . It would stand better near to *Buccinum glans*, than in the place which Linnaeus has assigned it among the shells of this division." Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 166) in a footnote to *Buccinum mutabile* Linné, commented on Dillwyn's treatment as follows: "He distributed a part of the synonymy under the name of *Buccinum gibbum* of Bruguières [*sic*] and another under that of *Mutabile*, causing confusion in the latter species and particularly in attributing the Linnaean name to *Buccinum canaliculatum* [as he referred to the Chemnitz figures showing that shell]. This error of Dillwyn had its origin in Bruguière himself, who, under the name of *Buccinum gibbum*, cited the major part of the synonymy of the *Buccinum mutabile* of Linné." The confusion of both Born and Dill-

wyn arose simply from the fact that they did not appreciate the extreme variability of the species, in spite of its specific name.

Buccinum mutabile belongs in the genus *Nassarius* Duméril, 1806. It has often been improperly cited as the type species of the genus, which was monotypic for *N. arcularius*. Thiele, who used *Nassa* Lamarck, 1799, as the earliest valid name of this group, with *Nassarius* Froriep, 1806, in its synonymy, placed *mutabile* in the subgenus *Sphaeronassa* Locard, 1886, as the subgenotype. *Buccinum gibbum* Bruguière, 1789, and *B. foliosum* Wood, 1818, are synonyms of *mutabile* Linné.

The present species is figured in Reeve (1843–1878, vol. 8, *Nassa*, pl. 1, sp. 6a, b). The "Tableau encyclopédique" does not figure it. The Reeve figures show the typical *mutabile* having a spotted band immediately below the suture.

It is not described in the "Museum Ulricae," and no specimen of it is present in the Uppsala collection.

Buccinum neriteum

1758, *Systema naturae*, ed. 10, p. 738, no. 399.

1767, *Systema naturae*, ed. 12, p. 1201, no. 461.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa convexa obtusa laevi, labio interiore explanato gibbo obsoleto . . . Testa magnitudine Pisi, facie Neritae, fere orbiculata, convexa, obtusae, laevis, pallida, sutura superiore secundum anfractus linea purpurascens vermiculari. SUBTUS PLANIUSCULA, alba, gibbosa. APERTURA postice emarginata, unde a Neritis diversa."

The entire diagnosis is identical in the tenth and twelfth editions. Linnaeus' orthography is reproduced exactly in order to show what is assumed to represent the emphasis he placed on certain features of the shell.

The characteristic description, the Mediterranean locality, and the accuracy of the only two figures cited (Gualtieri, pl. 65, figs. C, I) were responsible for the early identification of this abundant species.¹ There is no documented specimen in the Linnaean collection in London, but an unmarked individual of the *neriteum* of authors is present,

¹ Gmelin (1791, p. 3481) spoke of *B. neriteum* as being "rarius in Mari Mediterraneo." It is, however, an extremely common species in many Mediterranean localities and on the near-by shores of the Atlantic. Maxwell Smith (1909, p. 83) reported it as "alive in vast numbers" in the Bay of Cadiz region.

which uniquely conforms to the description and may probably be accepted as the ostensible type. The earliest valid generic name for *neriteum* is *Cyclope* Risso, 1826. The species has also, from time to time, been included in *Cyclops* Montfort, 1810, which is a synonym only in part, not Müller, 1785, *Nana* Schumacher, 1817, *Nanina* Risso, 1826, not *Naninia* Gray, 1834, *Cyclonassa* Swainson, 1840, *Cencus* Gistel, 1848, *Neritula* H. and A. Adams, 1853. Thiele (1931, p. 324) puts *neriteum* in the typical section of *Cyclope* Risso, which, however, he treats as a subgenus of *Nassa* Lamarck, 1799, as the subgenotype. Many European writers used *Neritula* for the species, and this use is employed by Nobre as late as 1938–1940 (p. 780).

Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 184, footnote) said of Schumacher's *Nana*: "This species [*neriteum*], well known to naturalists, has always remained among the Buccins, it having, indeed, all of the principal characters of that group. It is astonishing that M. Schumacher should have made a new genus for this shell, into which he introduced a *Melanopsis*." It is not apparent why these writers did not object to the generic names *Cyclops*, *Nanina*, and *Cyclonassa*, all of which had been published at the date they wrote (1844).

The Linnaean species is the *Cyclops asterizans* of Montfort, 1810, the *Nana nerita* of Schumacher, 1817, and the *Cyclope neritoidea* of Risso, 1826. It is also probably equal to *Trochus vestiarius*, var. β of Gmelin (1791, p. 3578), as one of the figures Gmelin cited for the latter (Chemnitz, 1780–1795, vol. 5, p. 72, pl. 116, fig. 1602, drawings 1, 2, 3) not only greatly resembles *neriteum*, but Chemnitz, who called it "Fabula nanae, Trochus vestiarius maris Mediterranei," also cited the Gualtieri figure cited by Linnaeus for *B. neriteum*. In the supplement to the "Gastropoda" in Risso's volume 4 (1826, p. 271), the author described two other species in *Cyclope*, *donoviana* and *pellucidus*. I have not seen specimens so labeled. Kiener was of the opinion that they represented merely worn and bleached individuals of *neriteum* Linné. Bucquoy, Dautzenberg, and Dollfus, on the other hand (1882–1886, p. 61), treated *donoviana* as a good species, with *pellucida* in its synonymy. They said of it: "This form is con-

sidered by many authors as a simple variety of *N. neritea*. It is, however, distinguished by its constantly smaller size, its general shape more flattened, its callosity more convex, and finally, its coloration." The "variety" *pellucida* is said to be even smaller than *donoviana*, with a thinner and more translucent shell, and by a color pattern of red, wavy, interrupted flammules and spots of opaque white arranged in two bands. Tryon (1879–1888, vol. 4, p. 65) does not mention *donovani*, but lists *pellucida* as a good species, describing it as "hyaline, with opaque white spots and callosity, frequently brown-spotted around the suture." While the authors who have thus discussed these two names are fairly agreed on their description, they differ widely as to their respective specific or varietal value. Not having examined a sufficient series of the immature *neritea*, I cannot pass judgment on the above opinions, but on the written evidence I would be inclined to agree with Kiener, that the two names were based on worn and bleached specimens.

The present species is figured in Reeve (1843–1878, vol. 8, *Nassa*, pl. 23, sp. 153a, b). Reeve's figure in the "Conchologica systematica" (1842, pl. 236, fig. 3) is also characteristic. Kiener (1834–1850, vol. 9, pl. 29, fig. 12o) has a good figure. The most recent figure seen by the writer is that of Nobre (1938–1940, pl. 28, figs. 11, four figs.).

Cyclope neritea is not described in the "Museum Ulricae," and no specimen of it is found in the Uppsala collection.

Buccinum harpa

1758, Systema naturae, ed. 10, p. 738, no. 400.
1767, Systema naturae, ed. 12, p. 1201, no. 462.

LOCALITY: "Ad Benghala" (1758, 1767).

"B. testa varicibus aequalibus longitudinalibus distinctis mucronatis, columella laevigata."

The only change made by Linnaeus in the description in the twelfth edition was the substitution of the word "varicibus" for "costis." It is entirely inadequate to identify the species, as it is little more than a generic definition. The synonymy, too, covers several species of the genus *Harpa*, among them the shells later called *nobilis*, *ventricosa*, and *minor* by Lamarck. A breakdown of the synonymy shows:

The following figures: Buonanni (pl. 185),

Lister (pl. 992, fig. 55), Rumphius (pl. 32, fig. L), Gualtieri (pl. 29, figs. C, E and G), Argenville (1742, pl. 20, fig. D) all show *nobilis* of Röding and Lamarck and almost all subsequent authors. That name was also used by Klein, Rumphius, Gersaint, Lesser, and Argenville and other pre-Linnaean authors. The Seba figure is equivocal. Plate 70 contains 30 figures, all of *Harpa* species, but, although Linnaeus referred to figure 10, only the first nine are numbered. One of the unnumbered figures shows *nobilis* very accurately.

Figure D of Gualtieri's plate 29 is a misshapen drawing. Its ribs are too narrow, and the lines across the ribs, one of the diagnostic features of *nobilis*, are too thread-like. Hanley (1855, p. 251) called it *H. articulata* (Lamarck, 1922). I would hesitate to identify it.

Rumphius' figure K (pl. 32) clearly shows *H. major* Röding, 1798 (*H. ventricosa* Lamarck). His figure M, on the same plate, shows a small *Harpa*, which is either *amouretta* Röding (*minor* Lamarck) or *doris* Röding.

Regenfuss' figure (pl. 2, fig. 14) has the shape, sculpture, and color pattern of *nobilis* Röding, but the actual color, as represented in the particular color plate seen, is a brick red. This suggests *doris* Röding, which was later named *rosea* by Lamarck, 1822. Regenfuss called it *Buccinum harpa* in his text.

The figure from Klein (pl. 6, fig. 105) appears to be *amouretta* Röding.

Petiver's figure (pl. 48, fig. 13) shows a *Harpa* species, but is specifically unrecognizable to the present writer. The aperture is somewhat too wide for any species with which I am familiar, and the ribs show no color pattern whatever. Thus the synonymy is made up of figures of *nobilis* and *amouretta* Röding and *ventricosa* Lamarck, with other figures which may possibly be intended to represent *doris* Röding and *articularis* Lamarck. *Harpa nobilis* is shown in six of the recognizable figures, a greater number than can be attributed to any other species. It seems to be obvious that Linnaeus, who was familiar with at least three of these shells, as his collection contained specimens of *nobilis*, *ventricosa*, and *amouretta*, believed them to be forms of a single species.

In the "Museum Ulricae" Linnaeus cited

only the several Rumphius and Gualtieri figures and the figure from Argenville. Hanley (1855, p. 251), noting that *nobilis*, *ventricosa*, and *minor* were all represented in this synonymy, made a somewhat equivocal restriction of the composite species. He said: "Of these, the first has the best claim to be considered the typical form of the 'Museum Ulricae'; since, of the eight figures there quoted, five are habitually quoted for it." This is not a perfect basis for the restriction of a composite species. As to the three remaining figures, he excluded Rumphius' figure M, which shows *H. minor* Lamarck, because of the word "ovata" of the description. Rumphius' figure K, showing *ventricosa* Lamarck, he excluded because it lacked the groups of dark, parallel lines required by the description. The Gualtieri figure D he conceived to represent *H. articulata* [sic] Lamarck (*H. articularis*)¹ and rejected it because its outer lip was not denticulate, as called for in the description. He was probably correct in his interpretation of these figures, but did not specifically restrict the *harpa* of the "Systema."

The description in the "Museum Ulricae" is much clearer and more detailed and suggests *nobilis* Lamarck, particularly by the phrases "costae vero striis transversis" and "spira brevissima." At least there is nothing in the description that is antagonistic to such an identification.²

The collections do not point to any one species as the representative of *harpa* Linné. In the London collection are found specimens of the juvenile and adult stages of *nobilis* (*harpa* Linné) as well as of *ventricosa* and *minor*, and none of these shells were documented by Linnaeus in any way. Nor does the Uppsala collection provide any basis for identification, as the lot labeled *Buccinum harpa* includes two specimens of *H. conoidalis* Lamarck (*H. davidus* Röding), and one specimen of *H. minor* Lamarck (*C. amouretta* Röding). No specimen of *nobilis* is present. It is certain

¹ In the "Liste" (1816, pl. 404, fig. 3) the species is listed as "*Harpa nobilis*." The figure was probably based on *nobilis*.

² Here again Linnaeus committed the error of confusing the two ends of the shell, as he said "antice mucrone pungentes," whereas the ribs of *nobilis*, as of many of the *Harpa* species, are spinous at their posterior end.

that Linnaeus, in writing the descriptions in the "Systema" and the "Museum Ulricae," had before him several species of the group, all of which he conceived to be forms of a single species. While the description in the latter work strongly suggests *nobilis*, it is not exclusively descriptive of that shell. The restriction suggested by Hanley has, however, been followed by an increasing number of writers. Others have continued to follow Lamarck (1822, vol. 7, p. 255), who referred his *H. ventricosa* to *harpa* Linné. On all the evidence, including Hanley's "preponderance of figures" argument, which is certainly preferable to the Lamarckian identification, it would seem wisest to restrict the Linnaean name to the shell long known as *nobilis* Röding.

Martini's plate of figures of the *Harpa* species (1769-1777, vol. 3, pl. 119, figs. 1091-1097) is instructive, as it was referred to by both Röding and Lamarck. Bruguière was the first to break down the Linnaean composite species, but only by listing several lettered varieties. Röding was, in turn, the first to supply specific names to the several species involved in *harpa* Linné, and these names, being the earliest, must be employed. The citation of the several Martini figures by Röding fixed most of the species. For his *H. major* he cited figure 1090, which is clearly Lamarck's *ventricosa* and which Lamarck later cited for that shell. For his *H. cythara* he cited only *Buccinum harpa* Gmelin, but, as Gmelin was as confused as to the separability of these various species as was Linnaeus, the reference is not helpful. For *amouretta* he referred to Martini's figure 1097, which is clearly the shell later called *minor* by Lamarck. For *nobilis* he cited Martini's figure 1091, an excellent figure of the *nobilis* of authors.

The Linnaean species is now in the genus *Harpa* Röding, 1798, of which it is the type species, by absolute tautonymy. The name *Harpa* had been used by the pre-Linnaean writers Rumphius and Argenville as well as by Chemnitz (1780-1795, vol. 10, p. 184). *Harpalis* Link, 1807, is a synonym,¹ as is the

pre-Linnaean name *Cithara* Klein, 1753.

Harpa harpa is well figured in the Martini drawing 1091, referred to above, by Reeve (1843-1878, vol. 1, *Harpa*, pl. 1, sp. 1, as *nobiis*), and by Maxwell Smith (1948, pl. 16, figs. 3, 6). The figures in the "Tableau encyclopédique" (pl. 404, figs. 3a, b) are less instructive.

For discussions of the nomenclature of the genus *Harpa*, the reader is particularly referred to Maxwell Smith's "Triton, helmet and harp shells" (1948) and Charles Hedley's "The nomenclature of *Harpa*" (1911).

Because of Lamarck's changes of several of Röding's specific names, the equivalents of the species probably included by Linnaeus in the synonymy of *B. harpa* are recapitulated:

H. harpa Linné, 1758, equals *H. nobilis* Lamarck, 1816

H. major Röding, 1798, equals *H. ventricosa* Lamarck, 1816

H. davidus Röding, 1798, equals *H. articularis* Lamarck, 1822, and *conoidalis* Lamarck, 1822

H. doris Röding, 1798, equals *H. rosea* Lamarck, 1816

H. amouretta Röding, 1798, equals *H. minor* Lamarck, 1822

Buccinum costatum

1758, Systema naturae, ed. 10, p. 738, no. "o."

1767, Systema naturae, ed. 12, p. 1202, no. 463.

LOCALITY: Not given in either edition.

"B. testa varicibus aequalibus longitudinalibus confertis mucronatis, columella laevigata . . . Simillima praecedenti, forte varietas, sed costae approximatae."

The only change made by Linnaeus in the description in the twelfth edition was the substitution of the word "varicibus" for "costis," as in the preceding species *B. harpa*, although he retained the word "costae" in the subscription, probably through an oversight.

In 1758 Linnaeus was apparently doubtful of the specific separability of *costatum*, as he did not give it a serial number but only designated it with a cipher. The description, how-

¹ It should be noted that Link, in listing *Harpalis*, referred it to *Harpa* Lamarck, 1799, rather than to *Harpa* Röding, although he used many of Röding's spe-

cific names, and failed to refer to either Linnaeus or Gmelin for any of his species except *Harpalis major* (*ventricosa* Lamarck).

ever, recognized the sculptural difference between it and the several species he had united under *harpa*, as it used the words "varicibus confertis" instead of the "varicibus distinctis" of *harpa*. In the twelfth edition he had apparently become sufficiently persuaded that it was a distinct species to give it a serial number, although he still left open the possibility that it might be a variety of the preceding by repeating the subdescription of the tenth edition.

Although no synonymy nor locality was supplied, the language of the description can probably be called adequate to identify it. The ribs of no other *Harpa* species can be described as "confertis." In *Harpa cancellata* Röding, 1798 (*H. striata* Lamarck, 1816?), the ribs are narrower and closer together than those of most of the other members of the genus, but they can hardly be called "confertis," and *cancellata* is otherwise distinguished by its smaller size and the fact that the spiral threads in the interstices give the shell a cancellate appearance.

Buccinum costatum is not found in the Linnaean collection in London, and the name does not appear on the lists of Linnaeus' owned shells. The description in the "Museum Ulricae," which refers to that in the tenth edition, confirms the identification with the *costatum* of authors by the phrases "costis triplo plurimus" and "antice [*sic*] minus pungentibus." The name *costatum* is, however, an unfortunate choice in a genus in which all species are provided with salient longitudinal ribs. A specimen of *costatum*, properly labeled, is present in the Uppsala collection.

Harpa imperialis Lamarck, 1822,¹ and *H. multicostata* Sowerby (1820, 1825–[1834], vol. 1, pl. 241, fig. 1, dorsal and ventral) are synonyms.

The species in included in the genus *Harpa* Röding, 1798.

The early figure from Martini (1769–1777, vol. 3, pl. 119, fig. 1093) is not good. The Chemnitz figure mentioned above is more

characteristic. The species is well figured by Reeve (1843–1878, vol. 1, *Harpa*, pl. 2, sp. 5, as *H. imperialis*).

Buccinum persicum

1758, *Systema naturae*, ed. 10, p. 738, no. 401.

1767, *Systema naturae*, ed. 12, p. 1202, no. 464.

LOCALITY: "In O. Asiatico" (1758, 1767).

"B. testa scabra, labro crenulato, columella plana."

The description is identical in the tenth and twelfth editions. It is inadequate to define the species. Only three details of the shell are mentioned, and two of these could be applied to many species. The third, "Columella plana," does suggest a member of the genus *Purpura* Bruguière, in which *persicum* is now included, but even this phrase is incorrect. The columella of *persicum* is not flat, but, although wide and typical of the genus, it has a deep depression running from the base through the lower two-thirds of its length, a feature seen in most specimens of the next species, *patulum*, save that in the latter species the depression is in the upper two-thirds of the columella. Linnaeus added another necessary detail, "Faux striata," in a manuscript note, but it seems obvious that the ready identification of the species was based on the description in the "Museum Ulricae," which is discussed below.

The synonymy is extremely discordant. The figure from Grew (pl. 9, figs. 5–6) seems to resemble the next species, *patulum*, rather than *persicum*. The Rumphius figure (pl. 27, fig. E), called *Cochlea patula* by Rumphius, is crudely drawn and, to the present writer, unidentifiable, although Hanley (1855, p. 252) thought it had the appearance of *Purpura haustum*. It was erased by Linnaeus' son in the latter's copy of the twelfth edition.²

Of the seven Seba figures cited, the last five (pl. 72, figs. 12–16) are likewise not *persicum* but were probably based on the shell later called "*Buccinum rudolphi seu persicum*" by Chemnitz (1780–1795, vol. 10, p. 196, pl. 154,

¹ The name *imperialis* was taken from Chemnitz (1780–1795, vol. 10, p. 184, pl. 152, fig. 1452), who referred his species to *Buccinum costatum* Linné. Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 129, footnote) criticized Lamarck's change of name to *imperialis*.

² The *P. haustum* mentioned by Hanley is *Buccinum haustum* Martyn, 1786, which was identical with *B. haustorium* Gmelin, 1791. It is described and figured by Chemnitz (1780–1795, vol. 10, p. 183, pl. 152, figs. 1449–1450) under the name of *B. hauritorium*. Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 59) placed it in the synonymy of *B. persicum*, but it is quite distinct.

figs. 1467–1468), a name adopted by Lamarck as *B. rudolphi* (1822, vol. 7, p. 235).¹ The remaining figures in the synonymy (Gualtieri, pl. 51, fig. L; Argenville, 1742, pl. 20, fig. E) and the other two Seba figures cited (pl. 72, figs. 10–11) are fairly accurate pictures of *persicum*, especially the figure from Argenville. Although the latter is only a dorsal view, it accurately reproduces the shape, sculpture, and color pattern of the shell. Argenville called it “la Conque Persique.” This was probably the source from which Linnaeus drew his specific name.

Linnaeus amplified his synonymy in a further manuscript note, by the addition of two further figures from Lister (pl. 987, fig. 46, and pl. 988). The first of these figures is clearly *persica*; the second shows what is probably *rudolphi* Lamarck.

The species is included in the genus *Thais* Röding, 1798, by many writers and is still placed in that genus in unrevised collections. It belongs, however, in *Purpura* Bruguière, 1789, and is the type species, by subsequent designation, Montfort, 1810. The genus was erected in the Index to volume 1 of Bruguière’s “Histoire naturelle des vers,” the only volume published by him before his death. No species were described, as the text of this first volume treated the genera in alphabetical order only as far as *Conus*. In 1792 (p. 29), he erected another *Purpura* which was identical with *Typhis* Montfort, 1810. Lamarck adopted Bruguière’s 1789 *Purpura* in the “Prodrome” of 1799 and continued to use it in his later works, placing the present species in it in 1822 (vol. 7, p. 235).

Apstein’s list of *nomina conservanda* was presented to the International Commission for adoption in 1915, and in the list Apstein included *Purpura* Bruguière, 1792, with *Buccinum persicum* Linné as type species. The Commission did not give blanket approval to the list, but ruled that each name should be treated on its own merits. Thiele (1931, p.

295) overlooked not only this ruling, but Apstein’s original confusion of the two purpuras, and listed *Purpura* as a *nomen conservandum* and attributed it to Bruguière, 1792. Winckworth (1945b, p. 143) corrected this error, accepted *Purpura* Bruguière, 1789, with *B. persicum* as type species, and recommended that it be added to the list of *nomina conservanda* by the Commission. Clench (1947, p. 64) quoted Winckworth with approval and discussed the history of *Purpura* in detail. His whole discussion should be read.

Purpura Bruguière, 1789, is identical with *Haustrum* Perry, 1811; *Microtoma* Swainson, 1840; *Purpurella* Dall, 1871, not Des Voidy, 1853, nor Bellardi, 1882; *Lepsia* Hutton, 1883; *Plicopurpura* Cossmann, 1903; and *Patellapurpura* Dall, 1909.²

The specimen of *B. persicum* in the Linnaean collection in London is undocumented in any way, but as the name appears on Linnaeus’ lists of owned species and the specimen uniquely conforms to the description both in the “Systema” and the “Museum Ulricae” and with the good figures in the synonymy it may be accepted as the probable or ostensible type specimen.

The description in the “Museum Ulricae” adds sufficient details to tie the species without question to the *persica* of all authors. The phrases “Striae transversalis, sex, laeves, albo nigroque catenulatae, saepe totidem aliae alternae minores” and “spirae anfractus minores punctis acuminatis, serie duplici,” together with the description of the outer lip and columella, are convincing. A specimen of *B. persicum*, properly labeled, is present in the Uppsala collection.

One of the earliest figures of the species (Martini, 1769–1777, vol. 3, pl. 69, fig. 760) is still one of the most characteristic. The black and white drawing in Crouch (1827, pl. 18, fig. 9) is an excellent picture of the shell. It is well figured in Reeve (1843–1878, vol. 3, *Purpura*, pl. 2, sp. 8).

Buccinum patulum

1758, Systema naturae, ed. 10, p. 739, no. 402.

² If *Purpura* Bruguière, 1789, should be rejected by the Commission, either as inadequately described or for any other reason, the next available valid name is *Haustrum* Perry, 1811, with *Haustrum zealandicum* Perry as type (*Buccinum haustoriim* Gmelin, 1791), by subsequent designation, Iredale, 1915.

¹ The spire of *rudolphi* is much more elevated than that of *persicum*, the whorls are more turreted and angular, the aperture is less patulous, and the columella is narrower. Its color pattern is more brilliant, consisting of a series of articulated black and white quadrangular spots or dashes arranged spirally. Tryon, however (1879–1888, vol. 2, p. 160), felt that *rudolphi* was so close to *persica* that they could not be separated. Clench (1947, p. 91) treats it as a subspecies.

1767, *Systema naturae*, ed. 12, p. 1202, no. 465.

LOCALITY: "In America" (1758, 1767).

"B. testa muricata, labro extus crenato, columella falcata. . . . Affinis Neritae nodosa, sed cujus apertura postice sinu exit; Neritae vero non. Anfractus ventris cingulo triplice nodoso acuto et duplici inferiore obtusiore."

The above description of 1767 contains material amendments of the original language of 1758, as follows: the word "extus" in the first sentence is added; "columella falcata" is substituted for "columella basi laevigata"; in the subdescription "hujus" is changed to "cujus"; the "triplici nodosa" of 1767 was "duplici nodoso" in 1758; and the last word, "obtusiore," was "convexo" in 1758.

Although the description leaves much to be desired, being almost as unilluminating as that of the preceding species (*persicum*) and although the synonymy is only partly correct, the species was correctly identified by all of Linnaeus' followers beginning with Martini (1769–1777, vol. 3, pp. 38–39, pl. 69, figs. 758–759), and this identification has never been questioned. Indeed, the shell was known to the predecessors of Linnaeus as early as the time of Buonanni (1684, pl. 368), and it was recognized by Lister, Sloane, and Petiver as being an American species. Its relationship with *Buccinum persicum* was stated by several early writers. Argenville (1742, p. 304) called it "une Conque persique," and Davila (1767–[1768], p. 214) "Conque Persique d'Amerique."

The main description, although brief and omitting important characteristics, is accurate as far as it goes. The subdescription is defective in two respects. The species bears little relationship to *Nerita nodosa* (the *Murex neritoideus* of the twelfth edition), and the number of rows of nodes was wrongly stated. All adult specimens of *patulum* carry six, or occasionally seven, rows, and in most cases the change from sharp to blunt nodes is more gradual than Linnaeus suggested. Indeed, in many individuals, those in the anterior rows are as sharp and spinous as those above. It is to be noted that the salience and sharpness of the nodes are greater in young individuals; in adult specimens they are usually blunt or partially obliterated.

Dissecting the synonymy, we find that one of the Gualtieri figures (pl. 9, fig. D) shows a

shell that cannot be identified specifically. It bears five rows of spines on the body whorl, but the aperture is not sufficiently wide for *patulum*. The other Gualtieri figure (pl. 9, fig. E) was probably based on *patulum*. Argenville's figure (1742, pl. 20, fig. H) is inaccurate. It is a dorsal view of what is apparently a very nodose *Drupa* species, and Argenville himself called it *Morum*. The figure from Buonanni (pt. 3, pl. 368) is equally uncharacteristic, as it does not show the wide parietal area of *patulum* or its extended aperture. Lister's figure (pl. 989, fig. 49) can be said to represent *patulum*. Adanson's figure of "le Pakel" (pl. 7, fig. 3) is undoubtedly *patulum* and is the only really accurate reference in the synonymy. It should be noted that there is no positive confirmation of the presence of *patulum* in west African waters. Fischer-Piette and his collaborators (1942, pp. 202–204), in their examination of the retained collection of Adanson (see Dodge, 1955, foreword to *Voluta*, p. 53) found three specimens of *B. patulum* labeled "2433, *Purpura* ad O. Pourpre Pakel du Sénégal." They wrote: "*Purpura patula* has never, to our knowledge, been reported from the west coast of Africa except by Adanson. The species lives in Central America and the Antilles. We know that a certain number of species are found both in the Antilles and in Senegal. We may expect that *Purpura patula* will one day be rediscovered in Senegal, as the description which Adanson gave for it is so accurate that one can hardly doubt that he had seen it there, as he said, 'This shell is quite rare. It is found on the rocks at Cape Manuel.' " Adanson probably recognized that the species was found in the western Atlantic, as he said in his catalogue which accompanied the retained collection: "It is also called the *Purpura* of Panama." Marrat, in his list of the mollusks of west Africa (1877, p. 244), reports the presence there of a *Concholepas*, without designating it specifically. Fischer-Piette and his co-authors (*loc. cit.*) refer to Marrat's listing, saying: "Might not this have been a worn example of *Purpura patula*?" *Concholepas* is sufficiently differentiated in appearance from *patula* that it would seem that such a suggestion would not be justified.

The statement in the subdescription of *B. patulum* as to the number of rows of tubercles

was partially corrected by Linnaeus in a manuscript note in his copy of the twelfth edition by adding the word "pluribusve" after the phrase "cingulo triplici."

The species is now placed in the genus *Purpura* Bruguière, 1789. Some writers until recently have placed it in *Thais* Röding, 1798, subgenus *Patellipurpura* Dall, 1909, and the relationship between *Purpura* and *Thais* has not always been understood. The capacious aperture of all *Purpura* species, their broad columella, and their depressed spire sufficiently differentiate the two genera. The reader is referred to Winckworth (1945b, p. 143) and Clench (1947, pp. 63-64) for very informative discussions of the history of *Purpura* Bruguière, and particularly of the confusion between *Purpura* Bruguière, 1789 and 1792, and *Purpura* Röding, 1798.

Purpura Bruguière, 1789, is identical with *Haustrum* Perry, 1811; *Microtoma* Swainson, 1840; *Purpurella* Dall, 1871, not Des Voidy, 1853; *Lepsia* Hutton, 1883; *Plicopurpura* Cossmann, 1903; and *Patellipurpura* Dall, 1909.

Haustrum tuberculatum Perry, 1811, not *Purpura tuberculata* Blainville, 1832, is the only exact synonym of *patula* (Linné).

The subspecies *P. patula pansa* Gould, 1853, was considered a good species by Gould, but his description seems to be a mixture of the characters of *pansa* and the typical *patula* of the western Atlantic. The subspecies is principally distinguished by the fact that the inner margin of its parietal shelf is white for most of its length. The typical species ranges from southeast Florida south to Trinidad, being particularly plentiful in the Bahamas. The subspecies *pansa* occurs on the west coast of Mexico and south to Colombia. It is also found in the Galapagos Islands.

A specimen of *Buccinum patulum*, authoritatively marked by Linnaeus, is present in the Linnaean collection in London. The description of the species in the "Museum Ulricae" corrected that in the "Systema" by noting the proper number of rows of tubercles, "Spinæ seriebus sex," amplified it by giving the details of the columella, "Columella depressa, plana, lunaris, pallido-fusca, nitida," and by noting the brownish red color of the aperture. The specimen now labeled for the

species in the Uppsala collection is the *Purpura patula* of all authors.

The best figures of both the typical species and the subspecies are found in Clench (1947, p. 65, pl. 33, fig. 1-4). It is not figured in the "Tableau encyclopédique."

Buccinum haemastoma

1767, *Systema naturae*, ed. 12, p. 1202, no. 566 [error for 466].

LOCALITY: "In O. Europaeo" (1767).

"B. testa submuricata, labro intus striato, columella planiuscula, fauce fulva . . . Testa ovata, rudis, cincta duplici fascia nodosa anfractu. Faux crocea, labrum intus crenulatum et striatum."

This is the *Thais haemastoma* of recent writers. In a genus in which such a great degree of variation is found in each species, the present species is perhaps the most variable. It is also the most widespread in its geographical range.

In sculpture, all forms of the species are provided with a series of close-set, incised spiral lines over both body whorl and spire, but many forms show two to four rows of nodules also arranged spirally. In some forms these nodules are blunt and in others coarsely spinose. The aperture varies in color from a deep salmon-pink to a light yellow or even white. The color of the outside of the shell is usually a dirty gray or chocolate brown, and in some forms both body whorl and spire show narrow spiral bands of color. The language of Linnaeus' description applies to only a single form, that with two rows of blunt nodes, but it is adequate to define that form as its other details are common to all. A specimen of the *haemastoma* of authors is properly marked in the Linnaean collection in London. This specimen has four rows of nodes instead of the two rows described by Linnaeus in the phrase "duplici fascia nodosa." The nodes in the lower two rows, however, are so much less conspicuous than those above that Hanley (1855, p. 253) suggested that Linnaeus thought them unworthy of mention. If Linnaeus had examined a sufficient series of the shell the conflict between his description and his type specimen could hardly have arisen.

The typical species, in its various forms, is found in the Mediterranean Sea, the Atlantic coast from France southward at least to the French Congo, in the western Atlantic from

Trinidad south to Uruguay, in the eastern Pacific from Baja California to Chile, and it has been recorded in the Pacific islands of Cedros and Juan Fernandez.¹

The single figure cited by Linnaeus (Gualtieri, pl. 51, fig. A) is clearly the *haemastoma* of authors, and this fact, together with a correct locality and the accuracy of most of the description, insured the early identification of the species.

It is placed in the genus *Thais* Röding, 1798, and in the subgenus *Stramonita* Schumacher, 1817, of which it is the subgenotype, by subsequent designation, Gray, 1847. Owing to its extreme variability and wide geographical range a great number of specific names, based in most cases on individual variations, have been suggested. Most of these are unnecessary, as the forms or individuals to which they have been allotted grade into one another through intermediates with no perceptible points of cleavage in shell characters sufficient to justify even subspecific separation. One "subspecies," *T. haemastoma forbesi*, Dunker, 1853, from the west African coast, is said by Clench (1947, p. 75) "to be fairly well differentiated," but he adds, "even this subspecies merges into the typical form." A long list of the principal synonyms of *haemastoma* is given by Clench (pp. 73-74), to which the reader is referred.

The representatives of the species in the western Atlantic north of Trinidad are *T. haemastoma floridana* Conrad, 1837, and *T. haemastoma haysae* Clench, 1927, and both are seemingly subspecifically distinct from the typical species. The first is somewhat less nodulose than the typical species, and the color pattern consists of dark brown dashes on its spiral ribs, or of a mottling of the same color arranged roughly in a longitudinal pattern, or both. Large specimens reach 75 mm. in height. In other respects its forms often parallel the forms of the typical *haemastoma*. It is found from North Carolina to southern Florida, through the West Indies, and on the South American coast as far as Trinidad. The second, *haysae*, is more markedly differentiated from the typical species. It is much larger, large specimens attaining a height of 105 mm., more solid, and with two rows of

strong tubercles at the shoulder. The sculpture, other than the tubercles, consists of numerous coarse, wavy, incised spiral lines, and the suture is deeply channeled. The entire shell gives a coarse and almost deformed appearance. Its range is limited to the Gulf of Mexico from northern Florida to Texas, and probably along the northern Mexican coast.

Buccinum haemastoma was listed by Röding under several specific names, *Thais grisea*, *metallica*, *nebulosa*, and *stellata*. He also listed a *T. panama*, which he referred to *haemastoma* Gmelin, 1791 (p. 3483), and to two Chemnitz figures (1780-1795, vol. 10, p. 196, pl. 154, figs. 1467-1468). Gmelin's *haemastoma* is clearly the *haemastoma* of Linnaeus, as the main descriptions are identical, Gmelin's subdescription is a mere paraphrase of that of Linnaeus, and the Gualtieri figure cited by Linnaeus is again referred to. *Thais panama* may therefore be safely added to the synonymy of *haemastoma*, in spite of the fact that the two Chemnitz figures cited by Röding were badly chosen. They seem to represent a *Purpura* species and are probably based on *P. rudolphi* Chemnitz (see p. 200, above) and were cited for that species by both Chemnitz and Lamarck.²

Thais haemastoma is figured by Clench (1947, p. 75, pl. 36, figs. 1-6, several forms of the typical species from the western Atlantic; and fig. 7, the "subspecies" *forbesi* from the west African coast). The subspecies *floridana* is also figured (p. 77, pl. 37, figs. 1-4) as is the subspecies *haysae* (p. 79, pl. 38, figs. 1-3). It is difficult to find good early figures of the species.

This species is not described in the "Museum Ulricae," and no specimen of it is to be found in the Uppsala collection.³

² Röding failed to cite two better figures of Chemnitz, which had been published in 1795 (1780-1795, vol. 11, p. 80, pl. 187, figs. 1796-1797) and which are clearly *haemastoma*. As they are represented as extremely large, the drawings being 95 mm. in height, they were possibly based on an individual from the southern end of the western Atlantic range (Brazil or Uruguay) of the species, where the shell becomes quite large and strongly nodulose. Probably this is the form that Reeve called *Purpura gigantea* (1843-1878, vol. 3, *Purpura*, pl. 4, sp. 17), but to which he gave no locality.

³ Linnaeus, however, supplied a figure of *haemastoma* in the "Museum Ulricae." A figure from Gualtieri (pl. 51, fig. A), which clearly shows *haemastoma*, was there added to the synonymy of *Buccinum patulum*.

¹ These limits of range are taken from Clench (1947, p. 76).

Buccinum lapillus

1758, *Systema naturae*, ed. 10, p. 739, no. 403.

1767, *Systema naturae*, ed. 12, p. 1202, no. 467.

LOCALITY: "Ad Oceani Europaei littora" (1758, 1767).

"B. testa ovata acuta striata laevi, columella, planiuscula . . . Turbini laterali convenit facie, loco, magnitudine, consistentia. *Purpura* aliqua ex hoc elicitus; vide Ström. sondm. 188."

The last sentence of the subdescription was added in the twelfth edition.

This species, the *Thais lapillus* of modern writers, is so variable in shape, structure, sculpture, and color pattern that language as limited and generalized as that of Linnaeus' main description can cover only one of its many forms. In some individuals the surface is smooth, in others spirally ribbed, and others seem to have a reticulated sculpture formed by the presence of imbricated scales, arranged in a longitudinal pattern crossing the spiral sculpture over all or a certain portion of the body whorl. It varies also from a roughly globular shell with a low spire to an almost fusiform shell with a more or less extended spire. Some forms are solid and heavy and some much lighter in structure, even in adult individuals. The color ranges from a dull gray to a reddish brown or deep orange, and some forms show a pattern of white spiral bands on a darker background. The form described by Linnaeus was the high-spired striate form. The subdescription adds little that is informative.

In spite of the insufficient description, the species was easily identified by the clear description in the "Fauna Suecica" (1761, ed. 2, no. 2167, unfigured), and the clear and characteristic figures from Lister (1678, p. 158, pl. 3, figs. 5-6), both of which were cited in Linnaeus' synonymy. His figure from Adanson (pl. 7, fig. 4) is clearly *lapillus* and is almost equally good. Adanson may not have collected his specimens of this shell, which he called "le Sadot," in Senegal. Fischer-Piette and his co-authors, in their examination of the retained collection of Adanson (see Dodge, 1955, p. 53) found 15 specimens of *lapillus*, and said on this point (1942, pp. 204-205): "We think that an answer to this question has been furnished by Lowe (1861, List shells Mogador, J. Linn. Soc. Lond. Zool. 5, p. 185), who remarks that Adanson, in his book,

has not noted that he collected the species in Senegal." Adanson, however, does say (1757, p. 107): "I have observed this species in the port of l'Orient [Lorient], at Ténérife in the Canaries, and at Fayal in the Azores, and I know it is frequently found on the shores of Brittany." Linnaeus' citation of "Act. paris. 1711. p. 199. t. 6. f. 5, 7" refers to a Memoire of the French Academy by Réaumur (year 1711, pp. 166-196, pl. 6, figs. 5, 7) which shows two recognizable figures of a form of *lapillus*.

By a manuscript note in his own copy of the twelfth edition of the "Systema" Linnaeus recognized one type of variability in the species by the phrase: "Colore variat," and also added an additional figure from Lister's subsequent work (1685-1692-[1697], pl. 965, fig. 19), which was possibly intended for *lapillus*. These items were to be included in his proposed "revised twelfth edition."¹

Martini (1769-1777, vol. 3, p. 428) listed and described a shell which he referred to the *lapillus* of Linnaeus' "Wästgota Resa," the "Fauna Suecica," and the "Systema naturae." His pertinent figures (*tom. cit.*, pl. 121, figs. 1111-1112) show a dorsal and apertural view of the spirally ribbed, high-spiral form of *lapillus*, with what appears to be imbricated scales on the ribs. On page 483 of the same volume Martini again cited these figures and called the species "Lapillus." Chemnitz, in 1780 (1780-1795, vol. 4, p. 22) redescribed *lapillus*, referred it to *B. lapillus* Linné and *Purpura lapillus anglicana* Lister, and supplied two pairs of figures (pl. 122, figs. 1124-1125, 1128-1129), the first pair showing the ribbed and imbricated form, and the second the comparatively smooth, brown form with white bands, which, as pictured, are so wide that the shell appears to have brown bands on a white background.

Müller (1776, p. 244), placed the species in his genus *Tritonium*, not *Tritonium* Link, 1807. Born, 1780, and Bruguière, 1789, left it in *Buccinum*. Röding, 1798, placed it in *Nassa*, as *N. rudis*. Link, 1807, and Dillwyn, 1817, returned it to *Buccinum*. Lamarck,

¹ The work to which Linnaeus referred in his subdescription as "Ström. sondm. 188." was not available to the present writer. Its full title and date are found in the Bibliography at the end of this paper, under Ström.

1822, used it for the first time, after Chemnitz, in *Purpura* Bruguière, 1789. Lamarck's *P. imbricata*, which immediately followed *P. lapillus* in his 1822 work, is now conceded by Clench (1947, p. 88) to be identical with *lapillus*, and, indeed, Lamarck suspected this common identity, as he said in his French description: "This shell may be only a variety of the preceding." Deshayes and Milne-Edwards were more explicit, saying (1835-1845, vol. 10, p. 80, footnote): "As Lamarck supposed, this species is really only a variety of *Purpura lapillus*."

Buccinum lapillus is now conceded to belong in the genus *Thais* Röding, 1798, not *Thais* Fabricius, 1807, nor Holiday, 1838. It is generally placed in the subgenus *Polytropha* Swainson, 1840, as the subgenotype, by subsequent designation, Gray, 1847. The variability of the species has resulted in a host of specific names, the best known of which are: *Nassa rudis* Röding, 1798; *Purpura imbricata* and *zonalis* Lamarck, 1822; *P. buccinoides* Blainville, 1829; *P. rugosa* "Lamarck" Kiener, 1836; and *P. celtica* Locard, 1886. *Buccinum filiosum* Gmelin, 1791, has been cited by some writers as a synonym, but the only reference cited by Gmelin (Martini, *tom. cit.*, pl. 121, figs. 1113-1114) cannot be specifically identified. Named varieties of the species, as described by their authors, are *crassissima*, *lactea*, *aurantia*, *castanea*, *lineolata*, and *fauciviolaceo*, all of Dautzenberg, 1887 (*vide* Clench; not seen); *citrina*, *caerulescens*, *monozonalis*, and *mixta*, of Dautzenberg, 1920 (p. 47); and *fusco-apicata* Dautzenberg and P. H. Fischer (1925, p. 44). The species has a greater variability in European waters than in the western Atlantic. This is particularly noticeable in shape and sculpture. The European shell also tends to attain a larger size.

The species has a considerable range on both sides of the Atlantic. In the west its recorded range is from eastern Greenland to Connecticut and the east end of Long Island. On the European side it is found from Novaya Zemlya in the Arctic south to Villanova de Portimao, Portugal. These range limits are taken from Clench (1947, p. 89). The Senegal locality is questionable, as mentioned.

Clench selected the Lister figure (1678, pl. 3, fig. 5) as the type figure, and added: "If Linné's types are not in existence, a neoholo-

type should be chosen from some locality in southern England that approximates this figure in Lister." While there is no specimen of *lapillus* in the Linnaean collection in London which is documented in the handwriting of Linnaeus, a specimen of *lapillus* is present, and, from the point of view of identification of the species, is the only shell in the cabinet that conforms to Linnaeus' description and his synonymy. It may, at least, be accepted as the probable or ostensible type specimen. The species was not described in the "Museum Ulricae," and there is no specimen of it in the Uppsala collection. Thus the only candidate for the type is the specimen in London, of which the only locality is Linnaeus' broad "Systema" locality.

In addition to the figure already mentioned, the species is figured in Reeve (1843-1878, vol. 3, *Purpura*, pl. 10, sp. 47a, b). Excellent photographs of several forms are reproduced by Clench (1947, p. 88, pl. 40, figs. 1-8). Cooke (1895, pp. 89-91) discussed the variability of the British *lapillus*, and (pl. 35), pictures 19 different forms of the shell.

Buccinum smaragdulus

1758, *Systema naturae*, ed. 10, p. 739, no. 404.

1767, *Systema naturae*, ed. 12, p. 1203, no. 468.

LOCALITY: Not given in either edition.

"B. testa ovata acuta glacerrima [*sic*], columella subplicata planiuscula."

The description is identical in the tenth and twelfth editions except for the addition of the word "subplicata" in the twelfth. The word "glacerrima" was a misprint for the "glaberima" of the tenth edition.

This is the species today called *Leucozonia smaragdula*. The description in the twelfth edition of the "Systema" should have been sufficient to identify the species, particularly when supported by the excellent figures from Seba (pl. 54, figs. 14, 15, 16). It is probable that the only other figure cited (Argenville, 1742, pl. 9, fig. P) was the cause of the early confusion as to *smaragdulus*, a confusion initiated by Gmelin. This figure, in which only a dorsal view is shown, is certainly not *smaragdulus*. It resembles a *Turbo* and is described by Argenville as being "of a pearly greenish luster" and "of a beautiful changeable green," whereas *smaragdulus* shows no green

color whatsoever, unless the periostracum, which is easily lost, could be described as a greenish brown. The shell itself is white, marked by spiral lines of brown. Linnaeus notes that Argenville called the shell "*Smaragdus minor*," but that name is not used in Argenville's text in its Latin form, being called "Emeraude." Linnaeus undoubtedly derived his specific name from Argenville, and in so doing provided the basis of the error which confused Gmelin, as is noted below. Hanley (1855, p. 254) regarded the Argenville figure as "a short, stunted example of the species," but Argenville's description would seem to repel that idea. A further fairly good figure of *smaragdulus* ("List. t. 831") was added by a manuscript note in Linnaeus' copy of the twelfth edition.

The identification with the *Leucozonia smaragdula* of modern writers is confirmed by the presence of a documented specimen of the shell in the Linnaean collection in London.

Martini (1769-1777, vol. 3, p. 427, pl. 120, figs. 1104-1105) supplied a pair of figures which are clearly *smaragdulus*, although he did not use that name nor refer to the "Systema naturae." He, however, cited for it the Lister and Seba figures cited by Linnaeus. Chemnitz did not describe nor figure the species.

Born (1780, p. 256) retained the species in *Buccinum*, but supplied no figure, although he cited the Argenville and Seba figures, a figure from Knorr (pt. 3, pl. 14, fig. 5), which is fairly characteristic, and the good Martini figures.

Gmelin (1791, p. 3484), apparently placing too much reliance on the Argenville figure, which he cited, based his *smaragdulus* entirely on this figure. Although he copied Linnaeus' description verbatim, his sub-description contained the word "perlarum" and the phrase "viride quoque colore nitente." He next (p. 3486) listed a *Buccinum rusticum* as a new species, without any reference to Linnaeus' *smaragdulus*, but which is patently that shell. His description is much more characteristic of *smaragdulus* than that of Linnaeus, and he cited the Seba figures used by Linnaeus and the Knorr figure added by Born.

Schumacher (1817, p. 240) erected a new genus, *Lagena*, for this species, calling it *Lagena crassa*.

Dillwyn (1817, p. 615) retained the species in *Buccinum*, used the Linnaean specific name, and correctly placed *B. rusticum* in its synonymy. His only error was to cite *B. smaragdulus* Gmelin in the same synonymy. This was the equivocal species which had the main description of *smaragdulus* Linné, a sub-description pointing to Argenville's "species," and a reference only to Argenville's figure. Dillwyn also cited as a synonym *Murex sulcatus* Gmelin (1791, p. 3549). This is a doubtful synonym. The only figure cited for it is from Adanson (1757, p. 132 [error for 133], pl. 9, fig. 25). Adanson called it "le Tafon." This is close to *smaragdulus*, although, as pictured by Adanson, the brown lines of the body whorl are shown as too close together and only very faintly drawn. Fischer-Piette and his co-authors, in their paper on the retained collection of Adanson (1942, p. 230) said: "This species has a very complex synonymy, which Dautzenberg has exhaustively studied (1921, p. 117). This author adopts the name *Tritonidea (Cantharus) sulcata* Gmelin. But the name *Murex sulcatus* Gmel. (based solely on the Tafon of Adanson) cannot be retained, because of the existence of a *Murex sulcatus* Born, which is of 1778 (Ind. rerum Mus. Caes. Vindob., p. 324); this species is a *Potamides* (see Dautzenberg and H. Fischer, Journ. de Conchyl., vol. 53, 1905, p. 128). So we use the name given by Kiener, which is unambiguous." The Kiener name is *Buccinum viverratum*. Fischer-Piette and others do not mention *smaragdulus* Linné in connection with "le Tafon," and the Adanson shell must be reckoned as a distinct species, although the present writer has never seen it, under either Gmelin's name or that of Kiener.

Lamarck (1822, vol. 7, p. 107) placed the present species in his *Turbinella*, 1799, a generic placement that was followed by many continental writers, and adopted Gmelin's specific name *rustica*. In his description and synonymy, however, he pointed to *smaragdulus* Linné as surely as did Gmelin. Deshayes and Milne-Edwards (1835-1845, vol. 9, p. 383, footnote) finally cleared up Gmelin's confusion, saying: "This is another species which must be revised in our catalogues. . . . Consequently, the double use of Gmelin being recognized . . . it should in the future take the name of *Turbinella smaragdulus*."

The description in the "Museum Ulricaë"

adds sufficient correct detail to confirm the identification, if confirmation were necessary. Unfortunately the type in the Uppsala collection is missing.

The species is now included in the genus *Leucozonia* Gray, 1847.

It is figured in Reeve (1843-1878, vol. 4, *Turbinella*, pl. 3, sp. 18, as *T. smaragdulus*). Reeve, in his text, cited both *smaragdulus* Linné and *T. rustica* Lamarck. It is also well figured by Kiener (1834-1850, vol. 5, *Turbinella*, pl. 19, fig. 2, dorsal and ventral aspects, as *T. rustica* Lamarck).

Buccinum spiratum

1758, *Systema naturae*, ed. 10, p. 739, no. 405.

1767, *Systema naturae*, ed. 12, p. 1205, no. 469.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa laevi, anfractibus canali plano distinctis, columella abrupta perforata . . . Variat anfractu suturae l. rotundato l. plano."¹

The addition of the subdescription was the only change in the twelfth edition. The description, thus amplified, covers, by its terms, two distinct species of the genus *Latrunculus* Gray, 1847 (*L. spiratus* and *L. areolatus*), and, were it not for the detail as to the umbilicus, could conceivably cover others. The two species differ radically in color pattern and in the rotundity or flatness of the upper edge of the whorls and the degree of canaliculation of the suture. In the *spiratus* of authors the color pattern is made up of irregular blotches of reddish brown, asymmetrically disposed over the whole whorl, whereas in *areolatus* the spots are more brilliant in color, more nearly quadrate, and are roughly arranged in three spiral rows. In *spiratus* the upper edge of each whorl has an angular top, with a suture so deeply canaliculate that it almost suggests those species of other genera in which the whorls are non-contiguous.

The description in the "Museum Ulricaе," although it repeats that in the tenth edition verbatim, adds a description of the color, "Color albidus maculis ferrugineis, triplici serie digestis," which indicates that the specimen described was *areolatus*.

The synonymy in the "Systema" also

¹ I am unable to determine what Linnaeus meant by the abbreviation "I" which occurs twice in the subdescription. In the original printing of the twelfth edition it is clearly the letter "I" and not a figure 1. The subdescription is not contained in either the tenth edition or the "Museum Ulricaе."

shows a composite species, and indicates that Linnaeus believed that the two shells were mere forms of a single species. The references are difficult to evaluate, as the artists, apparently being also confused as to this complex, gave to most of the figures characteristics of both species, showing the color pattern of one and the shape and structure of the other on the same figure.

Hanley (1855, p. 254) thought that the figures from Buonanni (pl. 70), Rumphius (pl. 49, fig. C), and Seba (pl. 73, figs. 23, 26) represented *areolatus*. I would question his opinion as to the Buonanni figure, and the Seba figures 23 and 26 are composite, having the color pattern of *areolatus* and the deep suture of *spiratus*. He also said that "most, if not all" of the other cited figures pertain to *spiratus*. This is probably true of Regenfuss' figure (pl. 10, fig. 41) and the other figure cited from Rumphius (fig. D). As to most of the others (Buonanni, pl. 370; Argenville, 1742, pl. 20, fig. N; and Seba, pl. 73, figs. 21-22, 24-25), they all show characteristics of both species. The Gualtieri figure (pl. 51, fig. H) is unrecognizable and does not even belong to the same genus. Both Rumphius figures and the Argenville figure were cited in the "Museum Ulricaе," where Linnaeus added another reference from Gualtieri (pl. 51, fig. B) which differs from any member of the genus with which I am familiar. Thus the only two figures that may unquestionably be cited for *spiratus* are Rumphius' figure D and the Regenfuss figure.

In dissecting the description and synonymy in the "Systema" and the "Museum Ulricaе," Hanley came to the correct conclusion that the "Systema" description could apply to both *spiratus* and *areolatus*, but that in the "Museum Ulricaе" only the latter was described. He added a further conclusion, however, the logic of which was faulty. He said: "It was fitting, therefore, since the name must be restricted to one species exclusively, that the preference should be given to that shell (Kiener, Coq. Viv., Ebur. pl. 2, f. 3), which alone answers to the characters specified in all the works of Linnaeus." The Kiener figure to which Hanley referred is an excellent figure of *areolatus*, and that species is the one that is covered by the description in both Linnaean works. The view of Hanley is pure sophistry, and, moreover, the restriction to *areolatus*

which he presupposes is not only tacit rather than categorical, but is not realistic and has not been followed. It is more fitting to select the name given to the species by its author, Linnaeus, in the tenth edition of the "Systema."

The Linnaean collection in London gives us no assistance in determining Linnaeus' type specimen, as the lot marked for *B. spiratum* consists of specimens not only of the *spiratus* of authors and of *areolatus* Lamarck but of a third species, *lutosus* Lamarck.

The present species has been included at various times in the genera *Eburna* Lamarck, 1822, not 1801, *Babylonia* F. Schlüter, 1838, and *Galanthis* Gistel, 1848, as well as *Latrunculus* Gray, 1847, where it properly belongs.

It is figured in Reeve (1843-1878, vol. 5, *Eburna*, pl. 1, sp. 7). Good figures of the other members of its genus mentioned above are found on the same plate. See also the "Tableau encyclopédique" (pl. 401, figs. 2a, b), which are inconclusive figures although called *spirata* in the "Liste."

Buccinum glabratum

1758, *Systema naturae*, ed. 10, p. 739, no. 406.

1767, *Systema naturae*, ed. 12, p. 1203, no. 470.

LOCALITY: "In O. Americano" (1758); "in O. Americano, Tranquebar" (1767).

"B. testa glaberrima, anfractibus obsoletis: infimo basi subcanaliculato producto . . . Testa quasi butyro s. oleo inuncta flava. Columella subperforata."

The description is identical in the tenth and twelfth editions. It is adequate to identify the Linnaean name with the *glabrata* of later writers. The phrase "glaberrima, anfractibus obsoletis," which, however, might have been better expressed as "suturis obsoletis," and the note in the subdescription as to the color of the shell, refer to the most important diagnostic features of the species.

The synonymy is not convincing. Hanley (1855, p. 254) was of the opinion that the references showed two distinct species, the *glabrata* of authors and the *Eburna zeylanica* of Lamarck, 1816. I cannot associate any of the figures with the latter species, although Lamarck cited two of Linnaeus' references for it (Lister and Klein). It would, in any case, be excluded by "anfractibus obsoletis" of the Linnaean description and the French description of *zeylanica* which refers to the violet

scales that decorate the anterior canal and columella.

The figure from Buonanni (pl. 149) is distorted and badly drawn and is to me unidentifiable. That from Lister (pl. 982, fig. 42) is equally bad. Gualtieri's two drawings (pl. 43, fig. T, dorsal and ventral aspects) seem clearly to be meant for *glabratum*. The Argenville figure (1742, pl. 12, fig. G, two figs. of the apertural side of the shell, of which one is designated by Linnaeus as "prior") might have been based on *glabratum*. Klein's figure (pl. 2, fig. 47) is apparently a copy of that of Lister.

The synonymy in the "Museum Ulricae" is modified by the suppression of the Lister, Klein, and Buonanni figures and contains only the figure from Argenville and the unquestioned figures of Gualtieri. The Lister figure was also erased by Linnaeus in his copy of the twelfth edition. The description in the "Museum Ulricae" is, as usual, more usefully characteristic, by the addition of the phrases "sutura distinguente oblitterata" and "Labium . . . interius vel adnatum, vel nulum, sed ejus loco canalis longitudinaliter flexuosus excurrens."

An unmarked specimen, which, however, uniquely conforms to the more explicit description in the "Museum Ulricae," is present in the Linnaean collection in London, and two specimens, properly labeled, are in the Queen's collection in Uppsala.

The species was originally placed by Lamarck in his genus *Eburna*, 1801, but Sowerby demonstrated that it was wrongly placed and moved it to *Ancillaria* Lamarck, 1810, where the majority of modern writers now place it. Thiele (1931, p. 334) retains the older *Ancilla* Lamarck, 1799, making *Eburna* Lamarck, 1801, a subgenus to contain *glabrata*.

It is figured by Reeve (1843-1878, vol. 15, *Ancillaria*, pl. 12, sp. 51a, b), and reasonably characteristic figures are found in the "Tableau encyclopédique" (pl. 401, figs. 1a, b). Crouch (1827, pl. 19, fig. 5) gives an excellent black and white drawing of the species. The most recent photograph is that of Thiele (*loc. cit.*).

Buccinum praemorsum

1758, *Systema naturae*, ed. 10, p. 740, no. 408 (*praemorsum*).

1767, *Systema naturae*, ed. 12, p. 1203, no 471 (*praerosum*).

LOCALITY: "In Europae australiore" (1758); "in Europae australiore, ad aquaeductum [*sic*] Seville. Alstrom" (1767).

"B. testa ovata laevi atra, spira cariosa, columellaglaberrima . . . Testa magnitudine fere Fabae, tota atra, rudis; vertex cariosus erosus et quasi praemorsus."

The description is identical in the tenth and twelfth editions, and the locality is amended only by the more localized reference to the aqueduct of Seville in the twelfth. Even in the absence of any synonymy, the clear and characteristic description of the species is adequate to identify it with the European *Melanopsis praemorsa* of modern authors. The change of specific name in the twelfth edition, from *praerosum* to *praerosum*, is hardly a change in meaning, if, indeed the terms are not interchangeable. Both mean "gnawed or worn away in front (at the top)." However, the name *praerosum*, being the earliest, must be used, under the terms of Article 19 of the Code of Zoological Nomenclature, the 1767 name being an invalid emendation.

Linnaeus was familiar with the species, as not only is the locality so accurately pinpointed and the collector stated, but specimens are present in a properly marked box in the Linnaean collection in London.

There has been some discussion as to whether the congener of this species found in the rivers of Greece and the Levant is specifically separable from that described by Linnaeus from Spain, and three variations in shell characters have been suggested by those who proposed new names for the Levantine form. The first is the relative amount of erosion of the upper whorls of the spire; the second, the peculiar distortion of the upper portion of the whorls; the third, the color of the shell. In general the specimens from western Europe are much more eroded than their eastern counterparts. I have seen no explanation advanced to account for this, but research might show a difference in the chemical composition of the waters in the two regions. The second difference was described by Hanley (1855, p. 255) as "the characteristic retusion beneath the sutures," and by Reeve (1843-1878, vol. 12, *Melanopsis*, pl. 1, sp. 10a, b, c, d) as follows: "The only

noticeable variation in the species occurs in a form represented in fig. 10b, in which the whorls are contracted and swell into an obtuse ridge round the upper part, and the shell is generally of a darker color." Although differently expressed, I assume that the two authors referred to the same feature. This variation is found in the shells from the western region and is usually associated with erosion of the spire. In general, the Levantine shell is free from erosion, has a fairly high and pointed spire, an olive-brown color, and a smooth, gradually sloping spire and body whorl.

There is, of course, no question but that Linnaeus was describing the western shell, as is shown by the exact locality, and the words "rudis," "spira cariosa," and "vertex cariosus erosus et quasi praemorsus." Indeed Hanley (*loc. cit.*), after examining the types in the collection, spoke of the "characteristic retusion" of the whorls "which distinguishes this Spanish species from its Grecian and Syriac congener *N. buccinoides*." This is confirmed by an examination of the types as shown on the microfilm of the Linnaean collection in the present writer's possession.

The variations exhibited by the shells from the two localities persuaded even some of the early writers to give the eastern shell a new specific name. Deshayes and Milne-Edwards (1835-1845, vol. 8, p. 490) refer to Poiret ("Prodr. p. 36"; not seen) as having called the shell *Bulimus antideluvianus*. Lamarck (1804, p. 295) also used this name for a fossil from the Paris Basin. Olivier (1801, pl. 17, fig. 8; not seen) supplied a figure of the Recent eastern shell, showing an uneroded, rather high and pointed spire. He called it *Melania buccinoidea*. Férussac (1807, p. 70) used the latter specific name, but put the species in his new genus *Melanopsis*, treating the Spanish shell as a variety. James Sowerby (1820, 1825-[1834], vol. 2, pl. 181, fig. 2) changed the specific name to *buccinoides*. In 1823 (1812-1829-[1846], vol. 4, p. 36) he listed a *Melanopsis fusiformis*, a British fossil that much resembles the eastern *buccinoidea*, and added: "Foreign collectors have confounded this with *Melanopsis buccinoides*, a shell that lives in the rivers between Tyre and Sidon, and is indeed very similar." Deshayes and Milne-Edwards (*loc. cit.*) disagreed with Sowerby, as they placed both *fusiformis* and

buccinoides in the synonymy of *praemorsa* Linné, which, in common with most nineteenth century writers, they listed as *praerosa*. In 1822 Lamarck (vol. 6, pt. 2, p. 168) described "*praerosa*" as *Melanopsis laevigata*, the description containing the words "ultimo spira longiore." He undoubtedly meant the eastern shell, as, in addition to the quoted words from his description, he gave the locality as "Les rivières des îles de l'Archipel," and cited Oliver's voyage (pl. 17, fig. 8) and an excellent figure of the smooth shell from the "Tableau encyclopédique" (pl. 458, fig. 8) as his only references. Incidentally, Deshayes and Milne-Edwards (*tom. cit.*, footnote) criticized Férussac for having changed the specific name. In this they were in error. Férussac used the name *buccinoidea*, which he borrowed from Olivier, for the eastern shell, as was proper. It is obvious that these authors were unwilling to separate the two shells as species or even subspecies, as they spoke of Linnaeus' shell as Spanish, and at the same time repeated Lamarck's eastern locality.

The question of the separability of the shells from these widely separated regions has been recently restudied by the United States National Museum, and the present writer is advised (Rehder, 1955, personal communication) that the Division of Mollusks of that museum is of the opinion that the two are specifically separable. It is a result that seems inevitable because of the several radical differences in shell characters between the two, as well as their geographical remoteness one from another.

In addition to the figures cited above, Chemnitz (1780-1795, vol. 9, p. 40, pl. 120, figs. 1035-1036) described and figured the eroded Spanish shell, with the obtuse ridge at the upper end of the whorls. Hanley (1855, pl. 2, fig. 5) supplied a colored figure of one of the actual paratypes in the Linnaean collection in London, which is clearly the Spanish species. Thiele (1931, p. 192, fig. 179) has an excellent figure of the smooth, high-spired species from the Levant.

Buccinum praemorsum is not described in the "Museum Ulricae," and no specimen of it is found in the Uppsala collection.¹

¹ Since the above comments on this species were written, the present writer has seen the monumental monograph on the *Melanopsis* of Spain by Florentino

Buccinum undosum

1758, *Systema naturae*, ed. 10, p. 740, no. 409.

1767, *Systema naturae*, ed. 12, p. 1203, no. 472.

LOCALITY: "In Asia" (1758, 1767).

"B. testa ovata: striis transversis elevatis glabris, ventre obtuse quinquangulari, labro intus striato."

The description of *undosum*, identical in the tenth and twelfth editions, together with the reasonable accuracy of three of the four figures in the synonymy, has always been held sufficient to identify the species with the shell now known as *Cantharus undosus*. The figures from Rumphius (pl. 29, fig. O), Argenville (1742, pl. 12, fig. N), and Seba (pl. 52, fig. 26) all resemble *undosus*, were probably based on it, and are generally cited for it. The Klein figure (pl. 3, fig. 61) is unacceptable. It shows what may be meant for *Triton clandestinum* Lamarck, 1822, which is shown in the "Tableau encyclopédique" (pl. 433, fig. 1) and which does not conform to the words "obtuse quinquangulari" of Linnaeus' description. By a manuscript note Linnaeus somewhat improved the description by substituting "Fauce striato" for "labro intus striato."

In the "Museum Ulricae" the faulty Klein reference was omitted, and the added details of the description in that work entirely conform to the *undosus* of authors.

A specimen of *Cantharus undosus* is found in the Linnaean collection in London. While it is not documented in any way and is only one of several specimens present that may be said to conform to the diagnosis, it comes closest to it and may be tentatively accepted as Linnaeus' probable type.

The species was included in the genus *Triton* Montfort, 1810, by Lamarck and a few of his followers, but Deshayes and Milne-Edwards (1835-1845, vol. 9, p. 642, footnote) first demonstrated that it was not a *Triton*. They seem to suggest that it should be returned to *Buccinum*, although their argument is not clear. It is today placed in the genus *Cantharus* Röding, 1798, not *Cantharus*

Azpeitia Moros, in which several related species from North Africa and the Levant were also discussed and figured. He disassociates the eastern *Melania buccinoidea* of Olivier from the *Melanopsis praemorsa* of Spain, although he reports specimens indistinguishable from the former in Spain.

Cuvier, 1829 (Pisces), and in the subgenus *Polia* Gray in Sowerby, 1834, of which it is the subgenotype, by monotypy.¹ As *Buccinum undosum* it is also the type of *Tritonidea* Swainson, 1840, by subsequent designation, Herrmannsen, 1849.

Buccinum affine Gmelin (1791, p. 3490) seems to be a synonym of *undosus* Linné. It was so considered by Lamarck (1822, vol. 7, p. 190) and by Deshayes and Milne-Edwards (*loc. cit.*). The only apparent difference in shell characters is that in *undosus*, as described by Linnaeus and Gmelin, the body whorl is roughly angulated by the longitudinal plications, whereas *affine* is "cylindrico." In the series seen by the present writer no specimen was labeled *affine*, but the two sculptural forms graded into each other almost imperceptibly, although the two extremes might lead one to believe they were specifically distinct. Gmelin himself suspected their common identity, as he said: "an satis distinctum ab undoso?" He cited one figure (Chemnitz, 1780–1795, vol. 4, pl. 123, fig. 1135) which shows no angulation of the body whorl. The companion figure of Chemnitz (pl. 123, fig. 1145) is angulated. A further pair of figures was supplied by Chemnitz (pl. 122, figs. 1126–1127) in which the rotundity of the body whorl is broken by a few low and broad undulations. The variations mentioned are all within the range of

¹ The treatment of *Polia* Gray as a subgenus of *Cantharus* Röding is accepted by Thiele and many other modern writers. Grant and Gale (1931, p. 646), however, consider it an exact synonym, although it has a different type, the type of *Cantharus* being *C. globularis* Röding (*Buccinum tranquebaricum* Gmelin), by subsequent designation, Suter, 1913. Iredale (1912, p. 221), in his discussion of his new genus *Quoyola*, says of *Polia*: "When looking up this [Sowerby's 'Genera of Recent and fossil shells'] I noticed a footnote reading 'Since the above was written Mr. Gray has separated the last mentioned shell from *Purpura*, under the generic appellation of *Polia*.' This refers to the sentence '*Triton undosum* of Lam.: We suggest the probability of its forming a well distinguished genus in union with several other cognate species.' In the British Museum copy of Sowerby's work Mr. Edgar A. Smith has noted that *Polia* was not published by Gray until 1839, in the Zoology of Beechey's Voyage; this latter has generally been quoted as the first entrance of *Polia*, whereas Sowerby's note has five years' priority. Moreover, the type (by monotypy) of *Polia* Sowerby, 1834, is *T. undosus* Lam., so that *Tritonidea* Swainson, 1840, would become an exact synonym, though probably both fall as equivalent to *Cantharus* Bolten, 1798."

variability of *undosus*, and all four figures are referred by Chemnitz to his "*Nassa undosa*," which, in turn, he referred to *B. undosum* Linné, without mentioning any sculptural forms. Tryon (1879–1888, vol. 3, p. 162) said: "Occasionally the shell has a few large, rounded, longitudinal ribs." This latter was the form seen by Linnaeus, although the unangulated form seems to be equally plentiful.

In addition to the early figures cited above, the species is figured in the "Tableau encyclopédique" (pl. 422, figs. 5a, b), both forms being shown. Reeve's figure of the evenly rounded form (1843–1878, vol. 3, *Buccinum*, pl. 8, sp. 55) is characteristic.

Buccinum bezoar

1767, Systema naturae, ed. 12, p. 1204, no. 473.

LOCALITY: Not given in either edition. Name of collector, Tesdorff, given.

"B. testa subrotunda rugosa, anfractibus antice lamellatis, columella perforata . . . Testa magnitudine pomi, rudis, decussatim rugosa s. striata, postice perforata. Anfractus ventris antice imbricati lamellis exstantibus, undulatis, numerosissimis. Spira angulata lateribus rectis, antice planiuscula, plicata aut superne dentata. Maxime affine murici."

In spite of the handicap of a synonymy in which the sole figure (Argenville, 1742, pl. 18, fig. G) is wrongly chosen, being a very fair representation of one of the more spinose forms of *Melongena corona* (Gmelin), and the lack of any locality, this species is satisfactorily identified from the description alone as the *bezoar* of at least all recent writers. By a manuscript note, Linnaeus added a further correct detail in the words "Faux striata." His phrase "antice lamellatis" should have been more accurately stated as "antice et postice lamellatis," at least so far as concerns the body whorl.

Some of Linnaeus' early successors were apparently puzzled by the species. Martini, in 1773 (1769–1777, vol. 2, p. 78), listed a shell that he called *Galeodes aspera*, and his figures (pl. 40, figs. 398–401), although poorly drawn, were apparently based on the shell later called *Pyrula galeodes* by Lamarck, although they are sufficiently like *bezoar* Linné to have confused Born (1780, p. 259) who based his own "*bezoar* Linné" upon them. The true *bezoar* is represented in Born's work

(*op. cit.*, p. 307, unfigured) by the variety "β" of his *Murex rapiformis*, for which he cited another figure from Martini (*op. cit.*, vol. 3, pl. 68, fig. 755) which was undoubtedly based on *bezoar* Linné, and was cited for that species by both Dillwyn and Lamarck. Schröter (1783–1786, vol. 1, p. 343, no figure) also properly identified the species and cited the figure 755 of Martini to support it. Gmelin (1791, p. 3491), while merely repeating Linnaeus' main description, amplified the subdescription by the addition of helpful details, supplied a correct locality ("China") and referred to the good Martini figure mentioned above. It is possible, of course, that he merely lifted the Chinese locality from Martini's "chinesischen Meeres" or Davila's "China" (1767–[1785], p. 565, pl. 11). To illustrate again Gmelin's frequent role as a mere copyist, he also referred to the incorrect Argenville figure cited by Linnaeus. Dillwyn (1817, p. 630) apparently knew the species, attributed it to Linnaeus, and referred to Born's error. He also repeated Davila's locality, "Coasts of China."

Schumacher (1817, p. 314) erected a new genus, *Rapana*, to receive this species, calling it *Rapana foliacea*, although he did not mention its Linnaean origin. Unfortunately Schumacher erected the genus with two divisions, *Rapana* "α" and "β." The first had, as sole species, *R. foliacea*, which therefore becomes its type species, by monotypy. *Rapana* β was also monotypic, its only species being *R. flavesceus*, a new name for the *Nassa undosa tranquebarica* of Chemnitz (1780–1795, vol. 4, p. 35, pl. 123, figs. 1146–1147), the *Buccinum tranquebaricum* of Gmelin (1791, p. 3491), which is a species now placed in *Cantharus* Röding, 1798, and entirely distinct from the *bezoar* of *Rapana* α.

Deshayes and Milne-Edwards (1835–1845, vol. 9, pl. 514, footnote) criticized Schumacher's unusual treatment of *Rapana*, saying: "As we have said, the genus *Pyrula* is in need of reforms; but it is impossible to accept those which M. Schumacher proposes . . . This author has created a genus *Rapana* for *Pyrula bezoar*, in which he also includes *Buccinum tranquebaricum*. We believe that the genera so constituted cannot be adopted."

Synonyms of *Rapana bezoar* are: *Murex rapiformis*, var. β Born, 1780, *Rapana foliacea* Schumacher, 1817, and *Muriciformis trifo-*

liatum of the "Museum Geversianum," *fide* Dillwyn. It is also probably *Buccinum luxurians* Humphrey, 1786, of the Portland Catalogue. It is not *Buccinum bezoar* Born, 1780.

The species is figured by Reeve (1843–1878, vol. 4, *Pyrula*, pl. 4, sp. 15) and by Kiener (1834–1850, vol. 8, *Purpura*, pl. 17, fig. 49).

A properly documented specimen of *bezoar* is present in the Linnaean collection in London, but it was not described in the "Museum Ulricae" and is not found in the Uppsala collection.

Buccinum glaciale

1767, *Systema naturae*, ed. 12, p. 1204, no. 474.

LOCALITY: "In O. septentrionali ad Spitzbergam insulam" (1767).

"B. testa laevi substriata ovato-oblonga, anfractu infimo subcarinato."

As this is a common species in Scandinavian waters, it is curious that no specimen is found in the Linnaean collection in London, and there is no indication that Linnaeus ever possessed a specimen. However, in spite of the brief description in the "Systema naturae" and the lack of any synonymy, it was recognized from the first by the details given in the "Fauna Suecica" (1761, p. 523) assisted by the paucity of the molluscan fauna of Spitzbergen.

This is one of the circumboreal species, its range in the Atlantic extending from Arctic waters south to the Gulf of St. Lawrence and Nova Scotia in the west and the Orkneys in the east. In the eastern Pacific it is found as far south as the State of Washington.

Reeve (1843–1878, vol. 3, *Buccinum*, pl. 8, sp. 18) tentatively suggested that *B. angulosum* Gray, 1839 (1839, p. 127, pl. 36, fig. 6), was this species. Dall (1918, p. 231) named another shell, as a subspecies of *glaciale*, *B. glaciale parallelum*, from the eastern Pacific. It differs from the typical shell in the greater salience of the two heavy spiral cords at the periphery of the body whorl and the greater depth of the incised lines over the whole shell. In the most recent comment on these two names, Grant and Gale (1931, p. 668) reject the subspecific value of *parallelum*, saying: "This variety is so close to the typical variety that it hardly deserves separate recognition." These authors also treated *B. angulosum* Mörch in Dunker, 1858, not *B. angulo-*

sum Gray, as being synonymous with *paralelum* Dall, and also included *Tritonium carinatum* Dunker, 1858, not *B. carinatum* Gmelin, 1791, nor Turton, 1819, as synonyms. As to *angulosum* Gray they appear to disagree with Reeve's suggestion that it was identical with *glaciale* and to treat it as a good species, distinct from either *glaciale* or *angulosum* Mörch in Dunker. From the limited series of these so-called subspecies available to the present writer, they all seem to be within the acknowledged range of variation of the "typical" *glaciale*.

The species has been retained in *Buccinum* Linné by all authors.

It is well figured by Chemnitz (1780–1795, vol. 10, pl. 152, figs. 1446–1447); the figures in the "Tableau encyclopédique" (pl. 399, figs. 3a, b) are not satisfactory in their portrayal of the sculpture; the Reeve figures mentioned above (pl. 3, sp. 18) are characteristic; the most recent photographic figure is that of Abbott (1954b, pl. 24, fig. T).

The absence of a specimen of this species from the collection of Queen Louisa Ulrica in Uppsala as well as from the Linnaean collection in London is also strange.

Buccinum undatum

1758, *Systema naturae*, ed. 10, p. 740, no. 410.

1767, *Systema naturae*, ed. 12, p. 1204, no. 475.

LOCALITY: "In O. Europaeo" (1758, 1767).

"B. testa oblonga rudi transversim striata: anfractibus curvato-multangulis . . . Simillimum Murici antiquo et despecto, aequae rude. Ovarium Ellis corall. 32. f. B. b.; Vesicaria marina vulgo."

The description of this species is identical in the tenth and twelfth editions.

The accurate references (Buonanni, pt. 3, pls. 189–190; Lister, 1678, pl. 3, fig. 2; and Seba, pl. 39, figs. 78–80), together with the presence of a documented specimen of the shell in the Linnaean collection in London, insured its identification with the *undatum* of authors, although Linnaeus' description leaves something to be desired. The synonymy was further improved by the addition of a correct figure from Lister (1685–1692–[1697], pl. 962, fig. 14).

The species is primarily boreal and occurs on both sides of the Atlantic, ranging from the Arctic south to the coasts of France in the east and of New Jersey in the west. It is ex-

tremely variable in sculpture, sometimes lacking the curved longitudinal ribs on the spire and upper part of the body whorl which are seen in the typical shell, and having a series of spiral threads of varying degrees of prominence. Bartsch (1922, p. 87) emphasized this variability as follows: "This species was described from Europe. As at present conceived it is a most variable form and will require intensive anatomic study and breeding to decide whether we are dealing with a fluxed hybrid element, or whether the name is made to cover a host of species. With the present state of our knowledge it would be folly to attempt a differentiation of the American from the European forms."

Its variations have produced many useless specific names. It is the *Buccinum vulgare* Da Costa, 1778, *B. striatum* Pennant, 1777, and *B. solutum* Hermann, 1781, and Gmelin, 1791. Dillwyn (1817, p. 634) said of the last name: "This shell is said to be allied to *B. undatum*, but is described with six unequal ribs, and the first and second whirl five times as broad as the others; spire obtuse, and the color whitish mixed with yellow; it is a doubtful species, and has been quoted by Schreibers for a variety of *B. undatum*." It is not possible to determine what shell Hermann had before him, but, recognizing the great variability of *undatum*, I would hesitate to base a distinct species on the above description, which is a paraphrase of that of Gmelin. Hermann's original description is equally uninformative.

Born (1780, p. 260, pl. 9, figs. 14–15) described and figured a rare sinistral form of *undatum*, and Chemnitz (1780–1795, vol. 9, p. 57, pl. 105, figs. 892–893) named this form *Buccinum Bornianum undatum contrarium*. The young shell of *undatum* was called *viridulum* by Fabricius (1780, p. 402) and Gmelin (1791, p. 3493). Dautzenberg and H. Fischer (1911, p. 14) treat *Buccinum flexuosa* Jeffreys, 1867, as a variety of *undatum*, as did Jeffreys (1867 p. 285). The latter writer also lists the varieties *littoralis* King, *paupercula* Jeffreys, *striatum* Pennant, *pelagica* King, and *zealandicum* Bruguière as varieties. Jeffreys' discussion (*tom. cit.*, pp. 287–293) of the range, habits, and habitats of *undatum* should be read.

This is another northern European shell that for some reason was not present in

Queen Louisa Ulrica's collection or described in the "Museum Ulricae."

It is well figured by Donovan (1799–1803, vol. 3, pl. 104), and by Reeve (1843–1878, vol. 3, *Buccinum*, pl. 1, sp. 3). Tryon (1879–1888, vol. 3, pl. 75, figs. 306–321) shows numerous forms of the species.

Buccinum reticulatum

1758, *Systema naturae*, ed. 10, p. 1204, no. 411.

1767, *Systema naturae*, ed. 12, p. 1204, no. 476.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa ovato-oblonga transversim striata longitudinaliter rugosa, apertura dentata . . . Testa omnibus facile coloribus varians, magnitudine Avellanae. (Animalium inhabitans Tritonem esse retulit D. D. Kaehler.)

The description is identical in the tenth and twelfth editions.

The species is unquestionably the *Nassarius reticulatus* of all modern writers, but as it immediately follows *Buccinum undatum*, which is a true *Buccinum* as restricted, and immediately precedes *B. nitidulum*, which is a *Nitidella*, rather than being grouped with the other *Nassarius* species, we are left with a feeling of uncertainty as to whether Linnaeus associated it with the latter group.

The description is reasonably clear, but the specific name, *reticulatum*, is not a happy choice. The association of relatively fine transverse striae with heavy longitudinal plicae, which are so dominant over the spiral sculpture that the latter is hardly noticeable except for the nodes formed by the intersection of the two sculptural series, is not a situation that gives the appearance of reticulation.

The synonymy contains enough good figures of the *reticulatum* of authors to define the species pictorially, even without the description.

Of the three Gualtieri figures (pl. 44, figs. C, E, G), the first two are clearly *reticulatum*. The last, figure G, was evidently an error of transcription, as it shows a very good picture of *B. papillosum* Linné, and was later erased by Linnaeus in his copy of the twelfth edition.

The Lister figure (pl. 966, fig. 21) is good, and Buonanni's figure (pt. 3, pl. 62), although crudely drawn, is recognizable for *reticulatum*.

The figure from Adanson (pl. 8, fig. 9), of a

species that Adanson called "le Covet," has been criticized as being equivocal. It has the shape and general appearance of *reticulatum*, but shows the spiral and longitudinal sculpture as of practically equal strength, giving the sculpture the appearance of a true reticulation. However, Adanson's description strongly suggests Linnaeus' *reticulatum*, and he cited for it most of the figures of the pre-Linnaean iconographers referred to that species in the synonymy in the "Systema," significantly omitting the erroneous Gualtieri figure G. It is to be remarked that the figures supplied by Adanson in the "Sénégal" work, which were drawn by another hand (Dodge, 1955, p. 53), are not uniformly good. The figures done by Adanson himself, which were recently discovered by Fischer-Piette and his collaborators, are in most cases more informative. Adanson listed his "Covet" as coming not from Senegal but from the Canaries and the Azores. He noted, however, that "it differs in no wise from the shell found on the shores of the Mediterranean." It is reasonably certain that his shell was *reticulatum* Linné. Fischer-Piette and his co-authors say of it (1942, p. 212): "But the figure supplied by Adanson shows the species very badly, with the result that many authors have expressed doubts as to its identity . . . We could discover [in Adanson's retained collection], and refer to le Covet, only a single specimen . . . marked merely with a numeral whose last digit is doubtful: 242(9?). It is *Nassa reticulata*. This shell, which lacks a label, has its callus incompletely formed. It is, therefore, not the specimen figured."

Petiver's figure (pl. 64, fig. 8) is possibly recognizable as *reticulatum* but has the same fault as the figure of Adanson in the representation of the sculpture. The longitudinal sculpture is no heavier than the spiral.

The two references to the Memoirs of the French Academy of Science ("Act. paris. 1710, p. 463, & 1771, p. 199") cannot be considered, as no descriptions or figures can be found in them which are authoritative.¹

¹ For the 1710 reference, the page cited by Linnaeus, 463, is part of an article by Réaumur, this part discussing certain species of "*Turbo*, *Trochus*, *Buccinum*, etc." No Latin or vernacular specific names are used, nor any figures supplied. For the 1711 reference, only one article on mollusks is contained in this volume, a paper on the habits of certain mussels. On plate 6 of this

Of the 10 references cited in the synonymy, therefore, seven have figures either clearly or probably based on the *reticulatum* of authors. In as much as the species in the tenth edition was supported only by the three Gualtieri figures, two of which are surely *reticulatum* and the other was a drawing abandoned by Linnaeus himself by a later manuscript note, we may say that the species was defined in that edition.

An undocumented specimen of the *reticulatum* of authors is present in the Linnaean collection in London. Hanley (1855, p. 257) said of it that "upon the whole, of those present, [it] best corresponds with the described features, stated size, and European locality." This is confirmed by the microfilm of the collection in the present writer's possession, and the specimen may be taken as, at least, the probable type specimen of Linnaeus. The words "Col[umella] adglutin[ata]" were added by Linnaeus by a manuscript note in his copy of the "Systema," a correct amendment of his description.

This species ranges to a point much farther north than the Mediterranean locality given to it by Linnaeus, as it is found on the European coast from Norway to Spain, as well as being plentiful in the Mediterranean. It is called the "Dog Whelk" by British fisherman. As early as Gmelin (1791, p. 3495) its English locality was recognized.

The young shell of *reticulatum* was called *Buccinum pullus* by Pennant (1812, vol. 4, p. 118, pl. 72, fig. 88). Gmelin's *Buccinum vulgatum* (1791, p. 3496) is generally considered to be merely another name for *reticulatum* Linné, which Gmelin described separately, as the description of *vulgatum* is completely characteristic of the Linnaean species and is supported not only by the good Gualtieri figure E but by two excellent figures from Chemnitz (1769-1777, vol. 4, pl. 124, figs. 1162-1163), which are as accurate representations of *reticulatum* as any that have been since published. Gmelin's locality for *vulgatum* is that of the *reticulatum* of authors,

volume figure 9 is a good drawing of the *reticulatum* of authors, but the plate refers to page 200, which is in an article entitled "Observations on Gonorrhea" (pp. 199-207). Linnaeus' reference was to page 199. Undoubtedly he meant this figure, but erred in referring it to the page mentioned.

Mediterranean and English waters and the Canaries and Azores. A form with a yellowish band around the whorls, which seems to be the typical form, at least in the Mediterranean, was called *Buccinum taenia* by Gmelin (1791, pl. 3493), who thus described the same shell three times under different names. He cited for *taenia* the same figure from Knorr (pt. 5, pl. 10, fig. 3) that he used for *reticulatum*. *Buccinum ambiguum* has been considered a somewhat doubtful synonym. Dillwyn (1817, p. 638) listed it as a good species, taking the name from his predecessors Pulteney, Montagu, and Maton and Racket, but, as he cited the *pullus* of Pennant and the *vulgatum* of Gmelin in its synonymy, and referred to a further pair of Chemnitz figures (*tom. cit.*, figs. 1165-1166), which are also clearly *reticulatum* and which were cited by Gmelin for his variety " β " of *vulgatum*, there seems little doubt but that the name should be thrown into the synonymy of *reticulatum*.¹ The present species is not *Nassa reticulata* Quoy and Gaimard, 1832, from Vanikoro.²

The species was included in the genus *Nassa* Lamarck by most of the early writers, and even today many continental authors so place it, but it is now generally put in *Nassarius* Duméril, 1806, as *Nassarius reticulatus*.

It is well figured by both Reeve (1843-1878, vol. 8, *Nassa*, pl. 9, sp. 57) and Tryon

¹ Dillwyn differentiated *ambiguum* from *reticulatum* "not only in being broader in proportion to its length, but also in having the ribs more distant, and the aperture rounder," but these differences are well within the range of variation of *reticulatum*.

² This rejection of Quoy and Gaimard's shell as being the *reticulatum* of Linnaeus is on the authority of Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 162, footnote). They based their opinion on certain anatomical differences in the animal and the absence, in the Vanikoro shell, of "a callosity on the penultimate whorl," which they attributed to the Linnaean species. I have not seen Quoy and Gaimard's species, nor am I familiar with the anatomy of either. The *reticulatum* of Linnaeus often shows a varix on the body whorl, the vestige of an earlier lip, and this at times extends over the suture to the whorl above. This may have been the "callosity" referred to. Quoy and Gaimard's figures, however (1832, atlas, vol. 4, pl. 32, figs. 16-17), do not show the varix, and I cannot distinguish them from *reticulatum* Linné. It would, however, be surprising to find the same species in the Mediterranean and on Vanikoro.

(1879–1888, vol. 4, pl. 18, figs. 340–345). The most recent photographic figure of the Atlantic form is that of Nobre (1931, pl. 24, figs. 2, 2a). One of the best sets of figures is the early pair of drawings in Chemnitz (*tom. cit.*, figs. 1162–1163) mentioned above. Donovan's figures (1799–1830, vol. 3, pl. 76) are excellent, except that the longitudinal sculpture is not sufficiently emphasized in most of them. It is not figured in the "Tableau encyclopédique."

The species was not described in the "Museum Ulricae," and no specimen of it is found in the Uppsala collection.

Buccinum nitidulum

1758, *Systema naturae*, ed. 10, p. 741, no. 413.

1767, *Systema naturae*, ed. 12, p. 1205, no. 477.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa ovato-oblonga nitida fasciata longitudinaliter striato-rugosa, labro intus subdentato . . . Testa variat admodum colore et fasciis; saepe cingulo nigro circumdata. Columella labio minime replicato."

The entire tenth-edition diagnosis is copied verbatim in the twelfth. No entirely satisfactory identification has been advanced, and the present writer is unable to add anything useful to the comments of earlier workers. The sole figure cited by Linnaeus (Gualtieri, pl. 52, fig. C) apparently, and indeed most certainly, shows a *Columbella* but is not sufficiently detailed to be specifically identified. Its use must have been the result of an error of transcription on the part of Linnaeus, as it does not conform to the important character "longitudinaliter striato-rugosa."

Several suggestions as to the identification of *nitidulum* have been advanced, but all but one may be dismissed for the same reason that the Gualtieri figure is unacceptable.

Chemnitz was the first to make an extremely tentative guess. In 1780 (1780–1795, vol. 4, p. 59, pl. 125, figs. 1194–1195) he described and figured a shell which he called *Buccinum laeve sinuatum* and located in Tranquebar. In spite of the word "laeve" in its name the figures show what may be very minute and crowded spiral incised lines, which are especially noticeable at the base of the shell. These, with the exception of the basal lines, possibly represent the artist's method of indicating shading, as they do not appear on

the highlighted portions of the drawing. This device for shading is often used in the Martini-Chemnitz plates. In any case they are not responsive to the phrase "longitudinaliter striato-rugosa." The figures somewhat resemble a *Bullia*, except that they show a less elongated spire and a short but more expanded aperture than in members of that genus. They also show a sinuosity or crenulation of the lower portion of the outer lip. I am not able to identify them. Chemnitz said of his species: "An *Buccinum nitidulum* Linnaei?," an expression that implies a doubt.

Bruguière (1789, 1792, p. 281) suggested that *nitidulum* was the "Bigni" of Adanson (1757, p. 135, pl. 9, figs. 27, dorsal and ventral aspects). Hanley (1855, p. 257) suggested that such an identification could be entertained only if one interpreted "longitudinaliter striato-rugosa" as "painted with wrinkle-like lines," as in the description of the clearly identified *B. laevigatum*, the next species in the "Systema," where "fusco-striata laevi" obviously means "smooth, with brownish irregular lines." Such a meaning, however, could not be attributed to "striata" unless it were modified, as in *laevigatum*, with a word descriptive of the smoothness of the shell. In any case, such a meaning is negated by the use of the word "rugosa" in *nitidulum*. One wonders why Hanley should have felt it necessary to attempt this rationalization of Bruguière's suggestion. Adanson's figures of "le Bigni" are too vague to be identified with any certainty. The question of the identity of Adanson's shell has, however, been decisively settled by the discovery by Fischer-Piette and his collaborators (1942, p. 232) of 29 specimens marked "le Bigni" in the retained collection of Adanson (see Dodge, 1955, p. 53), all of which are *Nitidella laevigatum* Linné. They are labeled as having been collected in Senegal and, if this locality is correct and there seems no reason to doubt it, add another species to the list of those occurring on both sides of the Atlantic. Photographs of one of Adanson's specimens are supplied by Fischer-Piette and his co-authors (1942, pl. figs. 12, dorsal and ventral aspects). This effectively disposes of Bruguière's suggestion.

Bruguière (*loc. cit.*), who listed *nitidulum* apparently as a known species, also believed that *B. laevigatum* Linné was merely an im-

mature *nitidulum*. This theory was adopted by Dillwyn (1817, p. 641), who said, "... Bruguière has ascertained that it is only the same species at an early stage of its growth" (*italics mine*).

Sowerby (1847-1887, vol. 1, p. 121, pl. 40, fig. 162) committed an error which has persisted in the minds of many conchologists. In his comments on the *Columbella nitidula* of the "Genera of shells" (1820, 1825 [1834], pl. 243, fig. 2) he said: "This very common species is the *Buccinum nitidulum* Lin. and the *Columbella nitida* Lam. Linné has confounded our *Col. concinna* with it. From Nevis and other West Indian islands." Sowerby's figure is an excellent picture of *N. nitidula* Sowerby, and none of the other names mentioned by him are identical with it. As a matter of fact Sowerby's suggestion was dismissed by Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 271) in a footnote to the listing of *Columbella nitida* Lamarck. They there said: "Several conchologists, among them Mr. Sowerby, attribute the *Buccinum nitidulum* of Linnaeus to this species. Indeed many of the characters listed by Linnaeus for his species are present in the *Columbella nitida* of Lamarck; but in our opinion the identification is not perfect because Linnaeus said: 'longitudinaliter striato-rugosa,' which does not describe a smooth and polished *Columbella*."

Hanley (1855, p. 258) very properly concluded that the Gualtieri figure of the "Systema" should be disregarded as repugnant to the diagnosis and added a much more credible suggestion of his own. He found in the Linnaean collection in London a specimen of *Nassarius cuvierii* (Payraudeau) which that author had described as *Buccinum cuvierii* (1826, p. 113, pl. 8, fig. 16), a shell from the Mediterranean Sea and the eastern Atlantic shores of Europe. Although the specimen was not marked by Linnaeus, it "precisely accords with both description and locality" of *nitidulum* Linné. I agree that the description of *nitidulum* Linné more nearly suggests a *Nassarius* than a member of any other genus, and I think it very probable that it belongs to that group. As to the choice of *cuvierii* as its representative I am uncertain. The fact that *nitidulum* was on Linnaeus' list of owned species and cannot otherwise be

isolated in the collection is considerable evidence in favor of Hanley's suggestion, although, as the specimen is unmarked, we cannot be certain that it was Linnaeus' type and may have been added by a later hand. For this reason and because of the deficiencies of the description of *nitidulum* I am strongly inclined to advise the dropping of the name and treating the shell as a *species dubia*, although I think it probable that Linnaeus was describing *cuvierii*. An examination of a considerable series of the latter shell and a comparison of the description in the "Systema" with them and with Payraudeau's figure of *cuvierii* and with the microfilm of the specimen in the Linnaean collection are almost convincing, but I agree with Hanley that "so imperfect was the definition in the 'Systema' that it is scarcely expedient that the name *nitidula* should take precedence."

I add the comment of the only comparatively recent writer who discussed this question. Tryon (1879-1888, vol. 4, p. 33) said of *cuvierii*: "This pretty little species is the victim of an immense synonymy, and of much uncertainty as to nomenclature. It is frequently referred to as . . . *N. nitidula* Linn. . . As regards the Linnaean name, the specimen bearing it¹ in the Linnaean collection has been identified with this species, but the only figure cited in the description is that of a *Columbella*. The description itself will suit almost anything."

For reference purposes *cuvierii* is well figured in the Payraudeau figure cited above and by Kiener (1834-1850, vol. 9, pl. 20, figs. 75-76).

Buccinum laevigatum

1758, Systema naturae, ed. 10, p. 741, no. 414.

1767, Systema naturae, ed. 12, p. 1205, no. 478.

LOCALITY: In M. Mediterraneo" (1758, 1767).
"B. testa ovato-oblonga nitida fusco-striata laevi, apertura edentula unilabiata . . . Testa

¹ Hanley merely said of *N. cuvierii*: "... that shell is present in the Linnaean collection, where it alone truly answers to the description [of *nitidulum*] (and our author has asserted his possession of it)." He did not say that the specimen was marked in any way, which is significant, as he usually mentioned the fact that a shell was marked with name or number. The photograph in the microfilm in the present writer's possession shows no marking, although this is true of most reproductions on the film. It would seem, therefore, that Tryon had read too much into the comments of Hanley.

praecedenti simillima, pallida, obsolete maculata striis obscurioribus, sed differt apertura minime dentata et columella absque labio; Spirae etiam minime plicatae sunt."

There is no doubt as to the species so described by Linnaeus. The description, which is identical in the tenth and twelfth editions, may with assurance be referred to the *Nitidella laevigata* of modern writers, a shell that is found in both the western and eastern Atlantic waters (see p. 216 above). Whatever may be the representative of the preceding species (*B. nitidulum*), the present species is differentiated from it by the use of unmistakable language. It is said to be smooth instead of rugose and provided with brownish lines and spots instead of the striae provided by the rugosity of the body whorl.

Bruguère, who listed *nitidulum* as an apparently known species, considered *laevigatum* to be merely the immature *nitidulum* (see discussion of *B. nitidulum* above).

Hanley (1855, p. 258) was less positive than his successors. He regarded the identification "rather as probable than as absolute," and based his doubt on the only figure cited by Linnaeus (Gualtieri, pl. 52, fig. B). This crude figure shows what is either a *Columbella* or a *Nitidella*, probably the latter, but is specifically undeterminable. It somewhat resembles *Nitidella nitidula* Sowerby, 1822 (1820-1825-[1834], vol. 2, pl. 248), which was originally described as a *Columbella*, not *B. nitidulum* Linné. Gualtieri's description speaks of it as minutely dotted with white on a reddish ground, instead of the "fuscostriata" of Linnaeus' *laevigatum*. It was probably, therefore, based on a specimen of *nitidula* Sowerby. The peculiar use of "striata" for "lines of color" in the description of the present species is discussed under the preceding species. From the "laevi" of the context there can be little doubt but that the term has this unusual meaning.

If Fischer-Piette and his collaborators (see p. 216, above) were correct in concluding that Adanson's specimens of *laevigatum* were collected in Senegal, then we have another species that occurs on both sides of the Atlantic, as it is common in the waters of Florida and some of the Antilles. It also occurs in the Mediterranean. Although the cited figure was badly chosen or was possibly an error of transcription, the excellent de-

scription is adequate to govern the identification. Linnaeus' references are often peculiarly undependable, as has already been noted in previous papers of the present series.

In the copy of the "Systema" owned by Linnaeus' son the word "parva" has been added to the description and "tota" inserted before "laevi," thus adding further confirmation to the identification.

The species is now contained in the genus *Nitidella*, erected by Swainson in 1840 to separate this group from Lamarck's comprehensive genus *Columbella* (1799), where it was long included. Lamarck himself, however, had retained the species in *Buccinum* Linné. Some modern writers, notably Thiele, still do not recognize *Nitidella* as a good genus but treat it as a section of *Columbella* Lamarck. It is an exact synonym of *Pardalina* Jousseaume, 1888, not Gray, 1867. The present species is probably identical with *Columbella concinna* Sowerby, 1822.

The Linnaean collection in London contains an unmarked specimen of *laevigatum*. It is not described in the "Museum Ulricae."

It is not the *Buccinum laevigatum* Chemnitz, 1780, which Gmelin (1791, p. 3494) renamed *B. laevissimum*.

The best figure of the species is found in Reeve (1843-1878, vol. 11, *Columbella*, pl. 11, sp. 53a, b). It is not figured in the "Tableau encyclopédique."

Buccinum maculatum

1758, *Systema naturae*, ed. 10, p. 741, no. 415.

1767, *Systema naturae*, ed. 12, p. 1205, no. 479.

LOCALITY: "In O. Africae, Asiae" (1758, 1767).

"B. testa turrita subfusiformi, anfractibus laevibus in divisis integerrimus... Testa flavescens maculis purpurascens."

The words "subfusiformis" and "in divisis" were added to the description in the twelfth edition.

This, the largest of the Linnaean *Terebra* species, was correctly identified by all of Linnaeus' immediate followers as early as Chemnitz and Born. So accurate is the description that the identification has never been questioned.

The synonymies, in both editions, need some correction. In the tenth edition three Rumphius figures were cited (pl. 30, figs. A, B, D), two of which are generally conceded to represent other species. Figure B appears to

be the next species, *subulatum*, and it was in fact again used for *subulatum* when that species first appeared in the twelfth edition. Figure D was clearly based on *Terebra oculata* Dillwyn, 1817. Figure B was omitted in the synonymy of *maculatum* in the twelfth edition, but the good figure A was retained along with the erroneous figure D. A Gualtieri figure (pl. 56, fig. B) was cited in the tenth edition. This also represents *subulata*, but in the twelfth edition figure I on the same plate of Gualtieri, a good figure of *maculatum*, was substituted. The Argenville figure (1742, pl. 14, fig. A), cited in both editions, is well chosen for *maculatum*, as are the Seba figure (pl. 56, fig. 6) and that from Buonanni (pl. 317). Thus the twelfth-edition synonymy is correct with the exception of the figure of *oculata* shown in Rumphius' figure D.

The species therefore may be said to be pictorially as well as descriptively defined. The locality "O. Asiae" is accurate. I have not seen a specimen of *maculatum* from as far west as the African coast.

The phrases "anfractibus . . . in divisis integerrimis," "anfractibus bifidis," and "anfractibus bipartitis" in the descriptions of the Linnaean *Terebra* species describe the difference in the manner in which the whorls are separated. In *maculatum*, *subulatum*, and *lanceatum* the first of these phrases is used, as these species show a simple suture, without any false suture below the true one or any band of color which might be said to simulate a false suture. The words "indivisis" in the description of *maculatum* were modified to "subdivisis" in the notes for Linnaeus' proposed "revised twelfth edition." As this species is typical of the terebras that have simple and entire sutures, the reason for this change is not apparent. The applicability of the other phrases is discussed under the species so described.

Buccinum maculatum is now contained in the genus *Terebra* Bruguière 1789 (1789, 1792, p. xv).

It is figured in Reeve (1843-1878, vol. 12, *Terebra*, pl. 1, sp. 4) and in Kiener¹ (1834-1850, vol. 8, pl. 1, figs. 1, 1a). See also Platt

¹ Kiener credited the name *maculata* to Lamarck, although Lamarck himself acknowledged that Linnaeus was the author. Kiener was also guilty of a slip of the pen, as in his list of species at the end of his monograph he spelled the name *maculosa*.

(1949, pl. 52, fig. 20). The figures in the "Tableau encyclopédique" (pl. 402, figs. 1a, 1b) are the best of the black and white drawings.

Terebra robusta Hinds, 1844, from the west coast of Central America simulates the present species very closely. That species is somewhat coarser and heavier in structure, less shining, and never attains the size of *maculata*. There are very slight differences in color pattern between the two shells.

The species was on Linnaeus' lists of owned species, and specimens are present in the Linnaean collection in London, although unmarked.

In the "Museum Ulricae," which was published between the dates of the tenth and twelfth editions of the "Systema," the synonymy reflects the errors of the tenth edition, as it cites all three of the Rumphius figures and both of the figures from Gualtieri. The description is much amplified, as usual, and clarified by the use of the following: "characteribus serie duplici: superioribus oblongis fuscis; inferioribus punctis ferrugineis." The two "varieties" described as "Variat colore luteo, characteribus albis; Colore fulvo characteribus nigricantibus," refer undoubtedly to *oculata* and *subulata* respectively, as shown in the Rumphius figures D and B in the synonymy.

Buccinum subulatum

1767, *Systema naturae*, ed. 12, p. 1205, no. 480.

LOCALITY: "In India" (1767).

"B. testa turrita subulata laevi indivisa integerrima . . . Pallida maculis ferrugineis in singulo anfractu per paria adscendentibus; differt a B. maculato minime gibba."

It is possible that when Linnaeus published the tenth edition of the "Systema naturae" he believed this species to be a form of *B. maculatum*, the preceding species, and that he elevated it to specific rank in the twelfth. As is said in the discussion of *maculatum* (above), one of the figures cited for the latter species (Rumphius, pl. 30, fig. B) in the tenth edition is clearly a picture of *subulatum* and was moved to the synonymy of *subulatum* when the latter was listed as a good species in 1767.

The description is the only entirely satisfactory definition of all the Linnaean terebras. The shell is distinguished from *maculatum* by the words "testa minime gibba." Although

the description fails to mention that the body whorl shows three rows of reddish brown spots, it defines the pattern of the remaining whorls with the phrase "in singulo anfractu per paria adscendentibus."

In the synonymy, the Seba figures (pl. 56, figs. 11, 16) may be disregarded. Figure 11 seems to show *Buccinum oculatum* Dillwyn, 1817, which does not have the color pattern of *subulatum*. Figure 16 is undoubtedly meant for *Terebra muscaria* Lamarck, 1822.

Possibly because of the citation of Seba's figure 16, the shell has been confused with *muscaria* by some early writers. The two are superficially similar in appearance. The latter, however, has all its whorls divided by a shallow sulcus just below the suture, giving the appearance of a whorl divided into two sections. In *subulatum* only the upper whorls are so grooved, the lower eight being simple and undivided. Also the squarish, red-brown spots of *subulatum* are always in three rows on the last whorl, and in two on all the others. In *muscaria* there are usually four rows of spots on the last whorl, three on the next three or four whorls, and two on the remainder. This progression in numbers is, however, very variable. A third difference is that the whorls of *subulatum* are noticeably terraced, which is not true of *muscaria*. The remainder of the synonymy (Buonanni, pl. 118; Rumphius, pl. 30, fig. B; Gualtieri, pl. 56, fig. B; Argenville, 1742, pl. 14, fig. X) consists of reasonably accurate figures of *subulatum*. The locality is correct.

This species has also been confused with *Buccinum tigrinum* Gmelin (1791, p. 3502,¹ second use), which equals *B. felinum* Dillwyn, 1817. This species is also superficially similar to *subulatum* in color pattern but has only a single row of spots on the base of each whorl, except on the last where there are occasionally two rows. It also has a slightly depressed line at the middle of each whorl, so that it approaches the appearance of those species having a divided whorl, although the latter feature was not mentioned by Gmelin. Lamarck did not list *tigrinum*, although it is a good species, and has been so considered ever since Lamarck.²

¹ Gmelin had already listed a *B. tigrinum* on page 3475, among the species later moved to the genus *Phalium* Link, 1807. There are several instances of this double use of a specific name by Gmelin.

With the exception of the temporary confusion with *muscaria* and *tigrinum*, the identification of the species has presented no complications.

It is very characteristically figured by Reeve (1843-1878, vol. 12, *Terebra*, pl. 6, fig. 22) and by Platt (1949, pl. 52, fig. 19). One of the early figures, that of Born (1780, pl. 10, fig. 9) is nearly as good as the recent photographic figures. The *subulatum* of the "Tableau encyclopédique" (pl. 402, figs. 2a, b) shows *muscaria*. Lamarck properly separated the two species (1822, vol. 7, pp. 285-286) and provided them with clear descriptions. In the "Explanation of Plates," however, the two were confused, the reference to the figures being: "*Terebra subulata*. *T. muscaria* Lamarck."³

The species is now included in the genus *Terebra* Bruguière, 1789, and is the type species of the genus, by monotypy, Lamarck, 1799.⁴

Dall (1921b, p. 125) identified *Buccinum subulatum* Linné with the *Buccinum taurinum* of the Portland Catalogue, but that species is now recognized as a good species, which was later called *Terebra flammea* by Lamarck (1822, vol. 7, p. 284). (See Abbott, 1954b, p. 265.)

The identification of the Linnaean species with the *Terebra subulata* of all authors was confirmed by Hanley (1855, p. 259) by the finding of a specimen of that shell in the Linnaean collection in London marked for *subulatum* in the handwriting of Linnaeus.

It was not described in the "Museum

² Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 253, footnote) detailed very comprehensively the features that distinguish the two species *subulatum* and *muscaria*. (See also Deshayes and Milne-Edwards, *tom. cit.*, p. 241, footnote.)

³ The figure from Chemnitz (1780-1795, vol. 4, p. 288, pl. 53, fig. 1441), which he called "*Buc. subulatum* Linnaei," is certainly incorrect. It shows a shell with a light brown background and black-brown spots, a divided whorl, and what appears to be a decussate sculpture over the entire shell. I do not know what it represents. The figure was cited for *subulatum* by Gmelin (1831, p. 3449) and by Dillwyn (1817, p. 642) for a variety of *maculatum*.

⁴ As *Terebra* Bruguière is a genus without species, having been described only in the Index (p. xv) of volume 1 of his "Histoire naturelle des vers," the only volume he lived to write, the first species assigned to it are those from which the type must be selected. Lamarck, in the "Prodrome" of 1799, assigned to *Terebra* a single species, *B. subulatum* Linné, which thereby became the type species, by monotypy.

Ulricae," and no specimen of it is present in the Uppsala collection.

Buccinum crenulatum

1758, *Systema naturae*, ed. 10, p. 741, no. 416.

1767, *Systema naturae*, ed. 12, p. 1205, no. 481.

LOCALITY: "In O. Africano" (1785, 1767).

"B. testa turrita, anfractibus bifidis margine crenatis."

The identification of this species with the *Terebra crenulata* of all authors has presented no difficulties. The description is reasonably clear, although the use of the word "crenatis" for the coronation of blunt spines at the shoulder of the whorl, and indeed the specific name itself, is not an exact use of the word. This is the first of the Linnaean terebras said to have a bifid or divided whorl. It must be recognized that Linnaeus used these words in the broadest possible sense. In *Buccinum duplicatum* the whorl is truly divided by a deeply incised line near the top of the whorl which simulates another suture, and although the sculpture of the whorl so divided is identical the two sections are of a different color. In *B. strigilatum* no line or other sculptural feature divides the whorl, the division being simulated by a band of white at the shoulder which is usually spotted with red-brown blotches. In *B. dimidiatum* the division is simulated by the fact that there is a noticeable terracing of the whorl below the suture, the upper portion of the whorl being abruptly narrowed at this point and of a solid color free from the spots or flammules which decorate the rest of the whorl. The present species deserves the word "bifidis" least of all. Just below the suture there is a very faint, narrow, and shallow sulcus encircling the whorl and decorated with a spiral row of very small dots. This sulcus is almost invisible, is often obsolete, and in most specimens is evidenced only by the slightly narrowed appearance of the whorl at its site. To call this a bifid whorl seems to stretch the meaning of the word unreasonably.

The synonymy is almost entirely accurate. The figure in Gualtieri (pl. 57, fig. L) and that of Argenville (1742, pl. 14, fig. Y), although crudely drawn, are obviously based on specimens of the *crenulatum* of all authors. The Seba figure, when corrected, is also of the same species. Linnaeus cited it as volume 3, plate 56, figure 35, which bears no resemblance

to the shell described by him, but the next figure on the plate, numbered 9, is a good figure of *crenulatum* and was doubtless the one intended. The locality is accurate, although too restricted, which is true of almost all his localities, as he usually had only a single specimen from a single locality available. This species ranges from the African coast eastward to the North and South Pacific as far as the Hawaiian Islands and Samoa.

An unmarked specimen of *crenulatum* is found in the Linnaean collection in London. It is, however, the only shell in the collection that can be said to agree with the description in the "Systema," and is in all probability Linnaeus' type.

Terebra fimbriata and *interlineata* Deshayes, 1859, are probably conspecific. Reeve (1843-1878, vol. 12, *Terebra*, pl. 2, sp. 6a) said that *fimbriata* was merely a form with a "richer display of color" than the typical *crenulatum*, but made *interlineata* a good species. Tryon, however (1879-1888, vol. 7, p. 8, pl. 8, fig. 1, the typical *crenulata*, fig. 2, *fimbriata*, and fig. 6, *interlineata*), treated both of Deshayes' shells as forms of *crenulata*, "illustrating the long persistence of juvenile characters," *fimbriata* because of the absence of tubercles at the shoulder, and *interlineata* for reasons not stated. I have not seen examples of either form.

Deshayes (1859, p. 276) believed that *Buccinum varicosum* Gmelin (1791, p. 3505) was a form of *crenulatum* and listed it as its variety "β." Gmelin cited only a single figure for his species (Seba, vol. 3, pl. 56, fig. 17) which shows a light-colored shell with a coronation that the artist may have meant for tubercles or blunt spines, and having a double row of dark dots on each whorl as in the typical *crenulatum*. His description might be taken for *crenulatum* except for the equivocal phrase "convexis coronatis bifariam" in the description of the whorls. There is no evidence of a double row of shoulder tubercles in the figure he cited.

The species is now included in the genus *Terebra* Bruguière, 1789. It is figured in Reeve (*tom. cit.*, *Terebra*, pl. 2, sp. 6b), in the "Tableau encyclopédique" (pl. 402, figs. 3a, b), and in Platt (1949, pl. 56, fig. 20). The Chemnitz figure (1780-1795, vol. 4, pl. 154, fig. 1445) is characteristic, although somewhat stylized.

In the "Museum Ulricae" the description copied that in the tenth edition of the "Systema," where the word "bifidis" was not used. In the additional description, however, this feature may be included by the phrase "Anfractus . . . margine supra lineam interstitialem crenato, obtuso," although the language is hardly intelligible. Linnaeus seems to have included the coronated shoulder and the "interstitial line," which I have referred to as a shallow sulcus, in a single phrase. Although the description, together with the same two figures from Gualtieri and Argenville which were cited in the tenth and twelfth editions of the "Systema," clearly points to *crenulatum*, the specimen bearing that label in the Uppsala collection today is *B. oculatum* Dillwyn, 1817. Its non-conformity with the diagnosis would, of course, indicate that there had been a mixture of specimens or labels in the collection, were it not for the fact that there is no specimen of *crenulatum* in the collection and that *oculatum* was not described in the "Museum Ulricae" under any name. The presence of this non-conforming specimen indicates, therefore, either that Linnaeus' specimen of *crenulatum* had been lost and an example of *oculatum* substituted for it by a custodian of the collection who was deceived by some of the figures of these two species in which the white "eyes" of the one and the tubercles of the other are, as drawn, very similar in appearance, or that Linnaeus in 1764 had a different conception of *crenulatum* than he had when he added a specimen to his own collection. This is a possibility not to be lightly disregarded and raises a scintilla of doubt as to the tenth-edition diagnosis of *crenulatum*. He may not have seen a specimen of either species at that date. It may be safely said, however, that the presence of a specimen of *crenulatum* in the London collection is probably an adequate confirmation that his concept of that species as of the date of the twelfth edition was the correct one.

Buccinum hecticum

1758, *Systema naturae*, ed. 10, p. 741, no. 417.

1767, *Systema naturae*, ed. 12, p. 1206, no. 482.

LOCALITY: "In O. Africano" (1758, 1767).

"B. testa turrita, anfractibus bifidis margine superiore compresso-attenuato."

This has always been a debatable species. The early literature contains several attempts to make it identical with *Terebra caerulea* Lamarck, 1822, or a pale variety of *Buccinum dimidiatum* Linné, but the striking differences between these last-named shells are sufficient indication of the fact that the diagnoses of Linnaeus and his immediate followers were confusing to conchologists.

The description of *hecticum* in the "Systema," to which the word "bifidis" was added only in the twelfth edition, might well be tied to *dimidiatum*, as the latter conforms to the words "turrita," "anfractus bifidis," and "margine superiore compresso-attenuato," the compression being effected in that species by the fact that the subsutural band is the depressed and narrowed upper stage of the whorl. It is in fact a better description of *dimidiatum* than Linnaeus gave to the latter shell itself, which merely says "Testa turrita, anfractus bifidis laevibus."

Linnaeus' synonymy consisted of two figures. The figure in Gualtieri (pl. 56, fig. C) shows a smooth shell with uniformly sloping sides, and with symmetrically decorated bands, which by the exercise of a little imagination might be referred to *caerulea*. The Seba figure (pl. 56, fig. 35) is probably a necessary correction. Two figures were apparently transposed. Figure 21, actually cited for *hecticum*, shows what seems to be *Terebra crenulata*; figure 35, which Linnaeus had already erroneously cited for *crenulatum*, is similar to Gualtieri's figure C cited for *hecticum*, which, as said above, much resembles *caerulea*. Thus both of Linnaeus' figures resemble *caerulea* more than they do any other species, except that in both the suture is more distinctly visible than in that shell, where the suture is almost obsolete, being either invisible or detectable only with the aid of a lens. *Buccinum caerulea* is a smooth, evenly sloping shell with undivided whorls. The synonymy and description are therefore in sharp conflict. One piece of evidence somewhat favoring *caerulea* as the species on which Linnaeus based his *hecticum* might be mentioned. Both figures in the synonymy are of a shell which in fact has a barely distinguishable suture. In the description of *vittatum*, the next species in the "Systema," the phrase "anfractus distinguens"

is used. As this phrase is not employed for any of the other Linnaean terebras, it might be argued that the author thus intended to call attention to the great difference, in this respect, between *vittatum* and the species immediately preceding it. I offer the suggestion merely to give all the evidence, however slight, on all sides of the question, although to explain why Linnaeus used certain words in his descriptions is anything but a rewarding task.

In 1780, Chemnitz (1780–1795, vol. 4, p. 292, pl. 154, fig. 1444) described a shell which he called *Subula fascia circumvoluta*, and referred it to a variety *lutescens*, which Born (1780, pp. 261–262, no figure) added to the description of *dimidiatum* Linné. Born's variety was described as "maculis longitudinalibus niveis, anfractuum margine superiore compresso," which conforms to the description of *hecticum* Linné. The subspecific or varietal name indicates the pale variety of *dimidiatum*. Chemnitz said of his shell (p. 293): "Is not this the *Buccinum dimidiatum* of Linnaeus?" He added, moreover, a paragraph which probably strengthened that theory: "According to Prof. Müller in the sixth volume of his comprehensive work on the *Systema naturae* of Linnaeus—and following Pastor Schröter's opinion in the fourth volume of his *Journal* where he discusses the Linnaean synonyms, in speaking of Knorr's volume 1, pl. 23, figure 5, this must be the *Buccinum hecticum* Linné."¹ In the Müller reference, the author cites *B. hecticum* Linné as a good species, and describes it as follows: "This is similar to the so-called spiral Needle shell, with the difference that the margin of the whorl appears compressed and thinned-out. As to color, it is golden red, decorated with white flammules, as large as the preceding [*crenulatum*] and from the same locality." This agrees with the Linnaean description of *hecticum* as far as sculpture is concerned, but the remarks on color and size are new and are of some assistance. Müller supplied no figure. The Knorr figure referred to was cited for *hecticum* by Müller, as well as by Schröter, and is a very good figure of the pale or pink form of *dimidiatum* Linné. Two

other Knorr figures (vol. 6, pl. 18, figs. 5, 6) were referred by Müller to *B. dimidiatum* (p. 473, no. 487). Figure 6 is poor but is possibly intended for *B. duplicatum*. Figure 5, however, clearly shows *dimidiatum* with pale yellow markings.

Chemnitz' own later listing of *B. hecticum* (1780–1795, vol. 11, pp. 95–97, pl. 188, figs. 1817–1818) is interesting. He referred it to the *hecticum* of the "Systema" and described it as "turrita" and as having "maculis quadratis rufescentibus pallidis." He did not use the word "bifidis," but indicated a divided whorl by the use of the expression "margine superiore gyrationum depresso seu attenuato, inferiore incrassato."

Hanley (1855, p. 260) makes a curious criticism of a claim Chemnitz is supposed to have made as to *Buccinum hecticum*. Hanley said: "Unfortunately Linnaeus did not himself possess this most puzzling shell, which has generally baffled the endeavors of naturalists to identify it: hence Chemnitz was deceived, when he flattered himself that he had determined it by the aid of the Linnaean collection, which was at that time in the possession of Sir J. Smith; the shell delineated by him agrees with the supposed pale variety of *Ter. dimidiata* in Hinds monograph of the genus, but bears not the least likeness to the engravings cited in illustration of *B. hecticum*." I can find no basis for Hanley's statement as to any such claim made by Chemnitz. Chemnitz mentioned *hecticum* only twice, as noted above, and in neither place is there the slightest intimation that he had even seen the Linnaean collection. Even if he had, Linnaeus never owned the shell on which he based his *hecticum*.

At the end of Chemnitz' discussion of *hecticum* he made two "observations" the first of which contradicts his suggested identity of *hecticum* with *dimidiatum* in his fourth volume:

"Obs. 1. One often finds *Buccinum dimidiatum* also with very pale pink spots. One should not thoughtlessly go on and presume that he has the rare *Buccinum hecticum* Linné. First, the other broad diagnostic characters must be present before one may turn to the coloration."

"Obs. 2. Herr Hofrath von Born, in his *Testaceis Mus. Caes. Vindob.* page 263,

¹ The Schröter work was not available to the present writer.

discusses a *Buccinum candidum*, whose figure is there seen on plate 10, figure 8. It is the antitype of our *Buccinum hecticum*. Ours has divided whorls adjacent to a constricted, depressed, and narrowed suture, but the other [Born's *candidum*] has undivided whorls adjacent to a swollen suture. I assume that its 'color niveus' is not natural, but that its real color pattern is bleached by the strong heat of the sun. It is therefore probably no new species, but a bleached *Buccinum dimidiatum* Linné."

I leave the reader to unravel the meaning of these two "observations." One is hampered in reading them, first, because it is necessary to realize that Chemnitz gave to the expression "divided whorls" a much narrower meaning than did Linnaeus; second, by the fact that Chemnitz was confident that he knew what Linnaeus' *hecticum* was, although he did not take us into his confidence as to how he arrived at his identification. On the question of color pattern, moreover, the two "observations" seem to contradict each other. One must not be deluded by the mention of quadrate spots. Although *dimidiatum* usually has a pattern of white flammules on an orange-pink or yellowish background, many individuals show square spots of color on a light background. One other confusing item is seen in Chemnitz' discussion of Born's *candidum*. He said that *candidum* had "undivided whorls adjacent to a swollen suture," which, even if we accept his narrow meaning of "undivided," does not describe any form of *dimidiatum*. Two sentences later (see above) he said that it was probably a bleached specimen of *dimidiatum*.

Gmelin (1791, p. 3500) copied the Linnaean description and synonymy and added a variety " β " for which he cited another figure from Gualtieri (pl. 56, fig. D). Figure D is made up of two figures, one of which is unrecognizable. The other has a subsutural band of what appear to be either tubercles or spots and might be intended to show *B. strigilatum*. His added subdescription: "Testa 4 pollices longa et longiori, alba, anfractibus singulis fascia obsoleta luteo maculata cinctis," might apply to the first of the Gualtieri figures cited under the letter D.

Lamarck did not even mention *hecticum*,

but Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 245, footnote) advanced the theory that it might be *caerulescens* Lamarck. Under the latter species they said: "Is not *Buccinum hecticum* the same species as this? Linnaeus, in his synonymy, cited two figures: that from Gualtieri, pl. 56, f. C, may be referred with fair certainty to *caerulescens*; the other figure is number 21 on plate 56 of Seba and must be referred to a different species from that shown by Gualtieri. This second figure resembles *Terebra dimidiata*, but is too doubtful for one to cite it for that species or for any other.¹ In a phrase unfortunately too short, Linnaeus said *anfractibus bifidis*, which cannot be applied to *caerulescens* . . . We do not know upon what Chemnitz relied in reestablishing the *Buccinum hecticum* of Linnaeus on a variety of *Terebra dimidiata* of Lamarck; nothing justified this opinion, to which M. Küster subscribes. In our view, *Buccinum hecticum* in one of those species which we must abandon because of the uncertainties in nomenclature which they entail."

The final conclusion of both Hanley and Deshayes and Milne-Edwards is one with which I am in accord, although I do not agree with all of the reasoning by which each reached this conclusion, nor with all their interpretations of figures or items in the Linnaean description.

A few years later Deshayes (1859, p. 318) said of *hecticum*: "A doubtful species. Under this name Chemnitz shows a variety of *dimidiata*, but in reality this opinion has nothing to justify it in the description or synonymy of Linnaeus." I cannot agree that the description of *hecticum* does not, however, paint a possible picture of *dimidiatum* Linné, even though the synonymy shows something different.

Neither Reeve nor Kiener listed *hecticum* or ventured to identify it, and, to my knowledge, it has not been listed by anyone since the above comments, with the exception of Tryon, who misinterpreted Hanley's remarks. Hanley had said (1855, p. 260) that *T. caerulescens* Lamarck was represented by a

¹ Deshayes apparently did not study the plate of Seba with enough care to see that there had been an obvious transposition of figures by Linnaeus, who should have cited figure 35, which is an acceptable figure of *caerulescens*. (See p. 222, above.)

specimen in the Linnaean collection and conformed to the tenth-edition description of *hecticum*, where the word "bifidis" was not included. He did not say that it conformed to the twelfth-edition description, nor that the unmarked specimen of *caerulescens* could be accepted as Linnaeus' type of *hecticum*. He was tempted to agree with Deshayes and Milne-Edwards that the two shells might be identical, but concluded with the words: "as to any change of name, that must be left to the judgement of my readers." Tryon (1879-1888, vol. 7, p. 31) in his comments on *caerulescens* said, however: "It is . . . *T. hecticum* Linné (*teste* Hanley)." Later, on page 39, Tryon cited "*B. hecticum* Gmel." in his list of undetermined species of *Terebra*. This is probably correct, as Gmelin's whole diagnosis of this name is too vague to justify any categorical identification.

Linnaeus did not own the shell on which his diagnosis of *hecticum* was based, as it did not appear on either of his lists. The specimen of *caerulescens* in the collection is strongly suspect, not only because it is not documented in any way and might have been added later, but because we have a direct conflict between the descriptions of *hecticum* in the two editions and a further conflict between description and synonymy. The species should be considered as undefined and the name dropped from the nomenclature.

It was not described in the "Museum Ulricae."

Buccinum vittatum

1767, *Systema naturae*, ed. 12, p. 1206, no. 483.

LOCALITY: Not given.

"B. testa turrita substriata, sutura anfractuum duplici crenulata . . . Testa ex ovata turrita, albida, remote transversaliter striata. Sutura duplicata, vix triplicata, articulata crenata, anfractus distinguens.

The only criticism that could be made of this excellent description is the use of the phrase "vix triplicata." It would have been more accurate to say "saepe triplicata," as many specimens of the shell have the sub-sutural tubercles divided into three rows instead of two. The synonymy consists of a single figure (Klein, pl. 7, fig. 121) which entirely conforms to the description and shows a reasonably accurate picture of the

Bullia vittata of all authors. The species may therefore be said to be descriptively and pictorially defined. In the manuscript notes for Linnaeus' proposed "revised twelfth edition" he added a further figure (Petiver, pl. 98, fig. 15). This shows a *Bullia* which is either *vittata* or its close congener *B. livida* Reeve, 1846, *vide* Hanley (1855, p. 261).

Reeve (1843-1878, vol. 3, *Bullia*, pl. 2, sp. 9), in discussing *vittata*, was not so confident of the exclusiveness of the Linnaean diagnosis. He said: "Two species appear to have been confounded under this head by Linnaeus and subsequent authors; that which I retain to represent it, answers best to the Linnaean diagnose [*sic*] and is the one figured in the 'Encyclopédie méthodique,' and by Kiener; the other species, which follows under the name *B. livida*, is that figured by Martini and De Blainville." I do not know whether Reeve based his opinion as to the composite nature of the Linnaean diagnosis on the phrase "vix triplicata" or on some other feature of the description. In any case *livida* is readily distinguishable from *vittata*, and I can see nothing in either Linnaeus' description or his figures that points to the former species. The color of *livida* is a brilliant blue in a fresh specimen and the aperture is a deep brown, whereas *vittata* is of a dirty white color with a light brown or yellow aperture. From the point of view of sculpture, the shoulder of the body whorl in *livida* has a single row of short rugae, and on the spire all whorls are so thickly tuberculate that one might describe them as "pebbled," whereas in *vittata* the subsutural band consists ordinarily of a double row of tubercles on both body whorl and spire, although, as said above, this number is not constant, many specimens showing three rows, or, rather, a single band of short rugae divided by shallow sulci into three rows of papillae.¹

Born (1780, p. 264) published a satisfactory description of *B. vittatum*, although he supplied no figure. Schröter's figure (1783-1786, vol. 1, p. 352, pl. 2, fig. 7) is the best

¹ In a fair proportion of specimens of *vittata* the double row of tubercles has apparently coalesced into a single row of short rugae. *Buccinum vittata* is also distinguishable from *livida* by the presence of a pronounced varix on the body whorl of some specimens, a feature I have not observed in *livida*.

that appeared for many years. Indeed, Lamarck called it "icon optimum."

Chemnitz described the species twice. In 1780 (1780–1795, vol. 4, p. 305, pl. 155, figs. 1461–1462) he described what he called *Turbo oro patulo*, but referred it to the *B. vittatum* of Linnaeus and cited also the Klein and Petiver figures cited in the "Systema." His locality was Tranquebar. The figures are unmistakably *Bullia*. Although figure 1461 has the color of *livida*, figure 1462 is *vittata*. In 1795 (*op. cit.*, vol. 11, p. 92, pl. 188, figs. 1814–1815) Chemnitz described the species under the Linnaean name but mentioned only one row of tubercles instead of two, using the expression "unica tantum serie crenularum in sutura anfractuum cincta." His two figures show this error, if error it be, as he may have used as his model a specimen in which the two rows have coalesced, as mentioned in my preceding footnote, or the figures may be bad figures of *livida* which omit the multiple tuberculation of the spire. On page 94 of the same volume Chemnitz lists a "Varietas notabilis Buccini vittati," which is described as having decussate sculpture instead of the simple and shallow spiral lines of *vittata*. His figure shows this sculpture very clearly (pl. 188, fig. 1816) and pictures a shell considerably narrower and more *Terebra*-like than *vittata*. Dillwyn (1817, vol. 2, p. 466) cited this latter figure for his "variety" of *B. vittatum*, describing it in some detail. I am unfamiliar with any *Bullia* or *Terebra* conforming to this description and figure. Chemnitz located it on the Malabar coast.

Schumacher (1817, p. 206) not only removed the species from *Buccinum*, placing it in the genus *Eburna* Lamarck, 1801,¹ but changed the specific name to *monilis*, a name that has not been adopted. Lamarck (1822, vol. 7, p. 291) again changed the generic name, placing it in *Terebra* Bruguière, 1789. This placement was followed by Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 251), who, however, added a disapproving footnote: "This shell does not belong in the genus *Terebra*: although more elongated than the majority of the Buccins, it is in that genus that it should be placed." This placement is

somewhat more realistic than that used either by Schumacher or Lamarck, but the species is definitely separable from *Buccinum* as well. It is now included in the genus *Bullia* Griffith, 1834.²

In addition to the figures mentioned above, the species is well figured in the "Tableau encyclopédique" (pl. 402, figs. 4a, b) and in Sowerby (1852, pl. 20, fig. 427).

An unmarked specimen is present in the Linnaean collection in London. The species was not described in the "Museum Ulricae."

Buccinum strigilatum

1758, *Systema naturae*, ed. 10, p. 741, no. 418.

1767, *Systema naturae*, ed. 12, p. 1306, no. 484.

LOCALITY: "In O. Asiatico" (1758, 1767).

"B. testa turrita, anfractibus bifidis oblique striatis."

This description, in which the word "bifidis" was added in the twelfth edition, is hardly a revealing definition of the species as it omits any reference to the color pattern, which is not only striking but was the undoubted basis on which Linnaeus rested his very questionable designation of the species as having a bifid or divided whorl. In this species there is a band of white around the upper margin of the whorl decorated with quadrate dark brown spots. There is no other "division" of the whorl, either by a ridge, an incised line, or a terracing at the middle of the whorl, as is the case with several of the species which Linnaeus called "divisis" or "bifidis." The presence of the colored band is the only excuse for the word. In Linnaeus' manuscript notes designed to be incorporated in his proposed "revised twelfth edition" he added the following: "Margo anfractus punctis fuscis," which goes far to clarify the de-

² In Griffith's edition of Cuvier (Griffith and Pidgeon, 1834) the name *Bullia* is proposed in the legend to plate 7, for figure 8. There is no description. In the "Explanation of Plates" (p. 596) the name is misspelled "*Bullaea*." In addition to the complication brought about by the misspelling, I question the advisability of basing a generic name on a mere plate heading. I have already, in a previous part of this series of papers, expressed my feeling in regard to the validation by the Commission of the "plate-heading" generic names attributed to Bruguière. The Griffith authorship of *Bullia* has, however, been accepted by Thiele (1931, p. 322) and followed by other authors and museums, and, as its validity is legalized by the Commission's ruling by implication, it must stand.

¹ This is not *Eburna* Lamarck, 1822, which, being a homonym, is replaced by *Babylonia* F. Schlüter, 1838.

scription. A further manuscript note, replacing "bifidis" with "simplicibus," shows that the author had realized that his earlier word was equivocal and misleading, or that he had completely changed his concept of his species. Indeed he may have changed it twice if we assume that the omission of "bifidis" in the tenth edition and its inclusion in the twelfth meant that he had used the word as indicating a divided whorl in the more accurate sense of the word. In the copy of the "Systema" owned by Linnaeus' son the following further clarification was added in manuscript: "Anfractus cincti ordine punctorum purpureorum."

The synonymy is almost entirely erroneous. The Buonanni figure (pt. 3, fig. 110) shows the next species, *Buccinum duplicatum*, which has a definitely divided whorl, and the citation of this figure is some indication that the author had given a more realistic meaning to the "bifidis" of the twelfth edition. Incidentally, this same figure was cited by Linnaeus for *duplicatum* itself. However, it was deleted from the synonymy of *strigilatum* by a further manuscript note, which again indicates that after the publication of the twelfth edition Linnaeus had changed his mind as to the species or had realized that he had merely used a misleading word. The figure from Rumphius (pl. 30, fig. H) shows, and is generally cited for, the species later called *Terebra myuros* by Lamarck in 1822. This species is unlike the *strigilata* of authors in that it has spiral rather than longitudinal sculpture and a subsutural band consisting of two spiral cords, each of which is thickly, although not prominently, tuberculate. The Gualtieri figure (pl. 57, fig. O) has a subsutural band which is not defined by terracing, the color pattern and sculpture of which are those of the *strigilata* of authors. It is a very fair picture of the species. Hanley (1855, p. 261) said that this figure conformed to the *strigilatum* of the tenth edition, where "bifidis" was omitted, but not to the *strigilatum* of the twelfth, and in this he was correct, depending on how well we can guess at what was in Linnaeus' mind as to the use of the disputed word. Hanley also described the Argenville figure (1742, pl. 14, fig. R) as not conforming to the twelfth-edition *strigilatum* for the same reason, but he must have misread the figure or was guilty

of a *lapsus calami*, as figure R is an excellent figure of the *strigilata* of authors, showing clearly the white subsutural band spotted with brown, which was incorrectly thought to simulate a divided whorl.

I do not know what Linnaeus had in mind in describing this species. The difficulty of determining the reason for his changes of wording, and the discordance of the synonymy in itself, make this an extremely unsatisfactory diagnosis. It is little wonder that some of Linnaeus' followers were confused.

Born (1780, pp. 264-265, pl. 10, fig. 10) gave an excellent description of the *strigilata* of authors. It used the phrase "anfractibus indivisis," although, as pointed out above, how far this word or its opposite may be used depends on the individual describer. He cited three of Linnaeus' references. Born's own figure is characteristic of the *strigilata* of authors, except that it does not show the longitudinal striae.

Chemnitz (1780-1795, vol. 4, p. 235, vignette 40, fig. 3) also shows a good figure of the *strigilata* of authors in his introduction to the section on the turbinids. It is an even better figure than that of Born, as it shows the oblique longitudinal sculpture. It is described on page 329 of the same volume, as "Die Tasche," is not referred to the *strigilatum* of Linnaeus, and there is no indication in the Chemnitz text, in spite of the good figure in Vignette 40, that the author thought that he was dealing with *strigilatum* Linné. In the same volume Chemnitz describes (pp. 302-303, pl. 155, fig. 1456) a shell called *Subula filamento granulato constricta et contexta*. While it is specifically referred to the *strigilatum* of the "Systema," both in the tenth and twelfth editions, Chemnitz' description in his text has not a point in common with that shell, and the figure is clearly based on *Terebra myuros* Lamarck, as it shows the double row of tubercles below the suture and the spiral sculpture. Even the name of his shell suggests *myuros*. It will be recalled that the Rumphius figure cited for *strigilatum* by Linnaeus resembled *myuros* and was called *Strombus 9, granulatus* by Rumphius, a name that suggests *myuros* and not *strigilatum*, and, furthermore, Chemnitz cited this figure for his shell. The evidence is thus complete that he identified *strigilatum* Linné with *myuros*.

The Gmelin diagnosis of *strigilatum* (1791, p. 3501) is equally equivocal. For his "typical" species he copied the Linnaean description and referred to the Rumphius figure of *myuros* and Chemnitz' figure of that shell. He also cited two new figures, Knorr (vol. 6, pl. 22, figs. 8-9) and Lister (pl. 845, fig. 73). The Lister figure shows a shell with very convex whorls and spiral sculpture which is undeterminable. The figures from Knorr are of an extremely narrow, elongated shell which has no resemblance to *strigilatum* of authors. They show a subsutural band of two cord-like ridges and spiral sculpture. It is quite apparent that Gmelin believed that *strigilatum* Linné was either *myuros* or a species closely allied to it. For his variety " β " he cited the Gualtieri figure cited by Linnaeus, which is clearly the *Terebra strigilata* of authors, the Argenville figure cited by Linnaeus which is equally convincing, and the good Born figure mentioned above. He also cited figure 1 on Chemnitz' Vignette 40, which must have been an error for figure 3, as it shows a shell broken open to show the spirality of the columella and with insufficient detail to show a particular species. A fifth figure cited was in Lister (pl. 979, fig. 36). This is probably meant for the *strigilata* of authors. Thus it seems evident that Gmelin relegated our *strigilata* to the rank of a variety of *myuros*. For his variety " γ " he cited a single figure (Lister, pl. 979, fig. 37), with a query. This is not determinable. His last variety, " δ ," was supported by another figure from Argenville (1757, pl. 11, fig. S) also with a query. This shows a pale and possibly bleached specimen of the *strigilata* of authors.

Dillwyn (1817, p. 647) did not use any of Gmelin's varieties, but erected a new one of his own, which he described as "Yellowish, and somewhat tessellated with red." Chemnitz' figure (*tom. cit.*, pl. 154, fig. 1452) is quite unrecognizable. It shows an extremely subulate shell with straight sides thickly strewn with orange oblong spots on the lower part of a divided whorl and with corresponding square spots on the upper part. Dillwyn also referred his variety to *Buccinum commaculatum* Gmelin. In Gmelin's listing of *commaculatum* the description is that of a shell having spiral sculpture, and his references, the Chemnitz figure which Dillwyn cited and figures 8-9 from Knorr, which

Gmelin also cited for his "typical" *strigilatum* do not conform to the description. The name *commaculatum* appears frequently in synonyms of *strigilatum*, but I cannot guess what it is. Dillwyn, for his "typical" *strigilatum*, referred to the "Systema" shell, the Chemnitz figure 1456, which is *myuros*, Gmelin's *strigilatum*, Rumphius' figure H of *myuros*, and the Knorr figures 8 and 9 which are unrecognizable. This hodge-podge of references is, however, aided by his description, which is an almost exact translation of that of Linnaeus, and may be said to describe the *strigilata* of authors. For Linnaeus' "bifidis" he used the phrase "transversely divided." His subdescription is here quoted in full, as it illustrates his confusion of mind even better than his discrete synonymy: "Shell about two inches and three-quarters long, and scarcely more than one-eighth as broad, whitish with yellow spots, which at times form square somewhat tessellated patches, and marked with a narrow elevated band both above and below the suture. The Linnaean description is so short, and the references so discordant, that this must always continue to be rather a doubtful species, and Born, under the name of *B. strigilatum*, has figured a very different shell. Martini's [*sic*] fig. 1452, from which Gmelin has constituted his *B. commaculatum*, is very indistinct, particularly about the aperture, and is most probably only a variety of this species."

I sympathize with Dillwyn's doubts as to the Linnaean description and the figure 1452 from Chemnitz, but particular attention should be called to the fact that his subdescription, quoted above, is utterly at variance with his main description and by no stretch of the imagination can be said to describe the *strigilata* of authors, which the main description, and Linnaeus' description as corrected by his manuscript notes, both do.

Lamarck (1822, vol. 7, p. 290) moved the species to *Terebra Bruguière*, 1789. His references included three figures of the *strigilata* of authors, already noted (from Gualtieri, Argenville, and Born), and Chemnitz' figure from Vignette 40, which Lamarck cited with a query. His description is extremely accurate, if we agree that he had before him the *strigilata* of modern authors.

Deshayes and Milne-Edwards (1835-1845,

vol. 10, p. 248, footnote) attempted to clarify and explain the several figures, with the result that has already been reached above. Two excerpts should be quoted: "It is evident that Linnaeus confused two species under the name *Buccinum strigilatum*. The figure cited from Rumphius represents the *Terebra myuros* of Lamarck, while the figures of Gualtieri and of Argenville should be referred to another and very distinct species for which Lamarck believed the Linnaean name should be preserved." And later: "This is not all there is to note in the work of Gmelin; indeed, we find, on page 3502, a *Buccinum commaculatum* which represents a double use of the variety α of *strigilatum* [Gmelin's] which, as we have just said, is *Terebra myuros*. *Buccinum commaculatum* being a repetition, should be suppressed, and, to avoid troublesome confusions in the nomenclature, it would be wise also to suppress *strigilatum* itself, since it involves two species in Linnaeus and at least four in Gmelin. M. Hinds, in his work published last year on the genus *Terebra*, proposes to reestablish *Buccinum commaculatum*, and to allot to it as a synonym the *Terebra myuros* of Lamarck. We think that Lamarck's name should be preserved, because as a double use *commaculatum* should disappear."

The difficulty inherent in the suggestion of Deshayes and Milne-Edwards is apparent. To suppress the name *strigilatum* itself would leave the *strigilata* of authors without a name. I admit that the Linnaean name, was badly and equivocally defined and technically should be left as a *species dubia*, but the name, as applied to the *strigilata* of authors, is so firmly fixed in the literature today that its suppression would cause too much confusion, as it would mean that conchologists would be forced to familiarize themselves with a new name. The only other alternative would be to call our shell *strigilata* Lamarck, which would be almost equally confusing. Hinds's suggestion to preserve *commaculatum* Gmelin in preference to *myuros* is technically sound, as it is the earlier name, but this change presupposes that we consider *commaculatum* to be clearly defined, which I am not prepared to admit.

Hanley remarked (1855, p. 261) that the Argenville figure, which seems to me to be an acceptable picture of the *strigilata* of authors, was in fact designed to represent *Buccinum concinnum* Dilwyn, 1817, which Dillwyn

synonymized with *strigilatum* Born, Gmelin's variety " β ," and the Gualtieri figure of *myuros*. He added, as to the Argenville figure, that it is "a narrower form, which has been termed *concinna* by Deshayes, and is so very closely allied that its essential differences may, perchance, be questioned." I agree with Hanley that *concinna* is not specifically separable from the *strigilata* of authors, and I cannot see in it the "essential differences" mentioned by Hanley. The latter said of it: "That shell forms part of the Linnean collection, and, if one might admit the manuscript substitution of 'simplicibus,' which Linnaeus made in his own copy of the 'Systema,' for the published 'bifidis,' would alone suit (since the typical *strigilata* of authors is not present) the altered description." According to Hanley, then, *concinna*, of which a specimen is in Linnaeus' collection, is not the *strigilata* of authors. As said above, I can see no difference between the two. The matter is, however, academic, as the specimen lacks all authority, because it was not the shell originally described, the name *strigilatum* not appearing on Linnaeus' list of owned species at the date of the publication of the tenth edition.

In summary, we have a description in the "Systema" which was twice changed in Linnaeus' lifetime, and we cannot be sure whether either change meant a change in his concept of the species or a mere alteration of a misleading word or the addition of a word to clarify the diagnosis. On one basis the description in the tenth edition vaguely suggests the *strigilata* of authors, and that in the twelfth some species with a divided whorl, depending on what we consider was Linnaeus' meaning of the word "divided." In the synonymy we have figures of three different species, one of which is the *strigilata* of authors. The divergent views of the writers quoted above sufficiently illustrate the confusion that the Linnaean diagnosis has caused. The species is, in my opinion, too vaguely defined to justify our identifying it with any of the species that have been referred to it. The difficulty is immeasurably increased by the fact that three of these species (*duplicatum*, *myuros*, and the *strigilata* of authors) are so remote from one another in shell characters that it would seem impossible to confuse them. While I strongly suspect that Linnaeus intended, by his de-

scription, to describe the *strigilata* of authors, I do not believe that we should make a positive statement as to the identity of a species in the absence of a positive conviction. Hanley (*loc. cit.*) was less troubled. He said that, if the name should be accepted, it will have been due to Born's figure and description, and continued: "... hence, in reference to it, it will be desirable to add 'as amended by Born,' " a solution which is not only clumsy but one which is not possible from a nomenclatorial point of view.

In spite, however, of our lack of conviction as to what Linnaeus meant, the name has become so firmly fixed in the literature as the *strigilata* of authors that it would be unwise to change it at this late date. The confusion that would result could hardly justify our adherence to the strict letter of any "rule-of-thumb" for the identification of a Linnaean species. *Terebra strigilata* is a common and well-known species, and there has not been a single voice raised against it in the last hundred years.

Some of the synonyms that have been published for the species, in addition to those discussed above, are *Terebra verreauxi*, *T. matheroniana*, *T. modesta*, *T. acumen*, *T. argenvillei*, all of Deshayes, 1859, and *T. lepida* Hinds, 1844. *Terebra cinerea* (Born), 1780, has been by some writers, notably Reeve, treated as a synonym, but seems quite distinct. It is a broader, less cylindrical shell than *strigilata*, is much less colorful, and the subsutural color pattern is less well defined, as is the sculpture.

In addition to the figures noted above, the species is figured by Reeve (1843-1878, vol. 12, *Terebra*, pl. 18, sp. 85a, b), and by Kiener (1834-1850, vol. 8, pl. 9, fig. 18). It is not figured in the "Tableau encyclopédique."

It was described in the "Museum Ulricae," where the description adds a puzzling phrase, "linea interstitiali obscura." In the examination of a considerable series of the *strigilata* of authors, I have not been able to detect a vestige of such a line. While the description is a copy of that in the tenth edition of the "Systema," and the synonymy is identical with the Linnaean synonymy, except that the Buonanni figure of *B. duplicatum* is omitted, the additional words not only cast a scintilla of doubt on the shell Linnaeus had before him

but tend to add to the doubts one has as to the identity of the "Systema" species. The Uppsala collection contains today a specimen of the *strigilata* of authors, properly labeled, but our knowledge of the vicissitudes which this collection has undergone, and the fact that all labels are the work of a later hand, make all the labels to a certain degree suspect. Incidentally, the existing label reads "*strigilata* Lam."

Buccinum duplicatum

1758, *Systema naturae*, ed. 10, p. 742, no. 419.

1767, *Systema naturae*, ed. 12, p. 1206, no. 485.

LOCALITY: "In O. Indico" (1758, 1767).

"B. testa turrita, anfractibus bipartitis-striatis."

The above description, identical in the tenth and twelfth editions of the "Systema," is entirely characteristic so far as it goes, but, as are all Linnaeus' descriptions of this group of species, is barely adequate for a categorical identification. It is a classic example of a *Terebra* with a decidedly "divided" whorl, the upper portion being set off from the lower by a deeply incised line which simulates a suture. The usefulness of the description to bring this out is, however, much lessened by the loose way in which Linnaeus used the words "divisis," "bifidis," and "bipartitis" in the other *Terebra* descriptions.

The synonymy is unsatisfactory. The figure from Gualtieri (pl. 57, fig. N) is extremely poor. Hanley (1855, p. 262) justly remarked that it "cannot be referred with greater certainty to any other known shell," which is hardly a convincing guess. The figure does show a row of dark spots around the top of the whorl, which is a feature of occasional specimens of the species. The figure from Buonanni (pl. 110) is equally poor but recognizable, and both were cited for *duplicatum* by Dillwyn, Lamarck, Kiener, Hinds, and others. Linnaeus added a third synonym ("List. 837, f. 64") by a manuscript note in his own copy of the twelfth edition, a figure that has also been constantly cited for the species. It is less informative, however, than the figures originally cited, as it is merely a highly conventionalized drawing of a *Terebra* with divided whorls and might be taken for any one of several species.

Although this is not a satisfactory diagnosis, the species was identified by all the earlier

post-Linnaean writers. A specimen of the *T. duplicatum* of all authors is found in the Linnaean collection in London, which, although unmarked, is the only shell in the cabinet that conforms to the description and the synonymy, such as it is.

The earliest figure of *duplicatum* was that of Chemnitz (1780–1795, vol. 4, p. 301, pl. 155, fig. 1455), a clear and characteristic picture of the shell. Chemnitz referred it to the *duplicatum* of the "Systema" and the "Museum Ulricae" and cited the earlier figures used by Linnaeus, although he called it *Turbo chalybeus*. Born (1780, p. 260) supplied a good description, but did not figure the shell.

The species varies considerably in color, ranging from shades of grayish blue, from dark to light, and to a yellowish or grayish white. Lamarck (1822, vol. 7, p. 286) described it as "cinereo-caerulescente," but listed a yellowish form as "[b] var. testa luteo-fulva." The specimen in the Linnaean collection is this latter color variety, as was, apparently, the *duplicatum* of Born, Schröter, Dillwyn, Wood, and Kiener. Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 243) cited the twelfth edition of the "Systema" for their "typical" *duplicatum* and for the variety "luteo-fusca" referred to the *duplicatum* of the tenth edition and the "Museum Ulricae." I find no authority for this in the tenth-edition diagnosis, although the shell described in the "Museum Ulricae" might be the variety of Lamarck. In all specimens, of whatever color variety, the upper portion of the divided whorl is constantly the lighter in color. This was referred to in the "Museum Ulricae" in the words "Color supra lineam interstitionalem pallidus, infra testaceus."

The species is now in the genus *Terebra* Bruguière, 1789, and has been placed by some conchologists in the subgenus *Diplomeriza*¹ Dall, 1919.

¹ *Diplomeriza* Dall (1919) was a new name for *Duplicaria* Dall (1908), which was substituted by Dall because of his feeling that the latter name had been preoccupied by Rafinesque (1833, p. 165). Rafinesque's name was given to a land shell and was spelled "*Dipli-caria*," not "*Duplicaria*." A Recommendation under Article 36 of the Code concerning new generic names "which differ from generic names already in use only in terminations or in a slight variation in spelling which might lead to confusion" suggests that such names

The species has few synonyms. Tryon lists a *T. dussumieri* Kiener as a good species, but added (1879–1888, vol. 7, pp. 16–17, pl. 3, figs. 46–47) that it was "too closely allied to *T. duplicata* Lamarck." He next cited *duplicata* Linné (pl. 4, figs. 49–50) without comment on his use of *duplicata* "Lamarck." *Terebra reevei* Deshayes, 1859, is merely a pale variety of *duplicata*. *Terebra lamarckii* Kiener seems identical with *duplicata*.

In addition to the Chemnitz figure mentioned above, the species is well figured by Reeve (1843–1878, vol. 12, *Terebra*, pl. 1, sp. 3a, b) and by Kiener (1834–1850, vol. 8, *Terebra*, pl. 12, figs. 26, 26a).

The Uppsala collection contains a specimen of *B. duplicatum*, correctly labeled.

Buccinum lanceatum

1767, *Systema naturae*, ed. 12, p. 1206, no. 486.

LOCALITY: "In India" (1767).

"B. testa turrita laevi, anfractibus integris lineis longitudinalibus testaceis. . . Testa apice laevissime striata. Cauda vix retusa."

The above description, which appeared for the first time in the twelfth edition of the "Systema," is one of the few Linnaean descriptions of a *Terebra* that is wholly satisfactory. There can be no doubt of its identification with the *Terebra lanceata* of all authors. Of the two figures cited in the synonymy that from Argenville (1742, pl. 14, fig. Z) is characteristic, although crudely drawn, as is the Rumphius figure (pl. 30, fig. G), the latter showing a shell somewhat more slender than the typical *lanceata*.

In Linnaeus' manuscript notes for his "revised twelfth edition" "simplicibus" has been substituted for "integris," and in the copy of the "Systema" belonging to Linnaeus' son the words "Anfractus lineis ferrugineis erectis" have been added to the description in manuscript. The word "erectis" is inappropriate for mere lines of color.

The species is variable only in the deepness of color in the longitudinal red lines and in their straightness or sinuosity. Its range is

should be "avoided." The Recommendation, however, continues, "but when once introduced, such names are not to be rejected on this account." One of the examples given, "*Macrodon*, *Microdon*," is a precedent for the present case. It was, therefore, not necessary for Dall to have selected the new name.

wide, being reported from localities as far apart as Madagascar and Tahiti. A record of a specimen from Ascension Island in the Atlantic, in the collection of the American Museum of Natural History, is without confirmation and probably erroneous.

The species is well figured by Reeve (1843-1878, vol. 12, *Terebra*, pl. 9, sp. 36).

The specimen of *lanceata* in the Linnaean collection in London has been accepted as Linnaeus' type, as the name was on his list of owned species, and the specimen alone agrees with the description in the "Systema."

It was not described in the "Museum Ulricaë."

Buccinum dimidiatum

1758, Systema naturae, ed. 10, p. 742, no. 420.

1767, Systema naturae, ed. 12, p. 1206, no. 487.

LOCALITY: "In O. Africano" (1758, 1767).

"B. testa turrita, anfractibus bifidis laevibus."

The description is the same in the tenth and twelfth editions of the "Systema," and my comment on its clarity is the same as that suggested for *B. duplicatum* (p. 230, above). I do not know just what different meaning Linnaeus gave to the word "bipartitis" for *duplicatum* and "bifidis" for *dimidiatum*. Likewise both species are described as "turrita," whereas, while *dimidiatum* has a turreted appearance produced by the constriction of the upper part of the whorl, in *duplicatum* the sides of the shell are evenly sloping, without "steps." The same observation should be made in the case of the preceding species, *lanceatum*, which is not in the least "turreted," although so described. It is apparently necessary to allow to Linnaeus a special meaning of "turrita," which does not involve the step-like narrowing of each whorl. No other shell characters are mentioned except for the word "laevibus," which equally applies to *lanceatum*. It is the shortest description of any of the Linnaean terebras except *duplicatum*.

No references were cited in the tenth edition. In the twelfth several Seba figures (pl. 56, figs. 16, 19, 23, 24, and 27) were given. Figure 19 is a poor drawing of what appears to be an immature *dimidiata*. The remainder are all forms of *T. muscaria* Lamarck, 1822. Several of these figures, however, together with a Lister figure (pl. 843), which

Linnaeus added to the synonymy in manuscript, were constantly cited for *dimidiata* up to comparatively recent times. There is little resemblance between *dimidiata* of authors and Lamarck's *muscaria*, and it is impossible to explain why Linnaeus should have cited the four erroneous Seba figures, especially as figure 15 on the same plate of Seba, which was not cited, is a good picture of *dimidiata*, except on the supposition that his *dimidiatum* is something other than the *dimidiata* of authors. As an ordinary rule the present writer gives more weight to the description than to the figures, but in the present case the description is too vague to be authoritative, and the synonymy certainly leans towards *muscaria*. In any case we are faced with a composite species.

Hanley (1855, p. 263) was unwilling to select the *dimidiata* of authors as the species that should carry the Linnaean name, arguing that Linnaeus' omission of the only good figure of Seba was very weighty evidence that Linnaeus' shell was not *dimidiata*. Likewise, Gualtieri, whose work was in Linnaeus' library, has a good figure of *dimidiata* (pl. 57, fig. M) which Linnaeus did not use, although it was on the same plate from which he drew figures of four of his other terebras. Hanley concluded by saying: "In accepting the traditional *dimidiata* we should at least qualify our reference to the Linnaean *Buccinum* by a 'partly.'"

Specimens of both *dimidiata* and *muscaria* were found by Hanley in the Linnaean collection, although both are apparently unmarked. In spite of this confusion both in the diagnosis in the "Systema" and in the collection, the description may be interpreted in one way which supports the claim of the *dimidiata* of authors to be considered as the representative of the name. Although the description is short, it is the only one of the *Terebra* descriptions where the mention of the "divided" whorl was not qualified by the mention of some feature not present in *dimidiatum*. *Buccinum crenulatum* has a "margine crenatis." *Buccinum vittatum* (which is not a *Terebra*, although Linnaeus classed it with that group) was said to be "duplici crenulata." *Buccinum strigilatum* was described as "oblique striatis"; *Buccinum duplicatum*, as "striatis." *Buccinum murinum*,

the next species, was described as "anfractibus subangulatis, striis tribus muricatis." Thus, by the process of exclusion, we may point to the *dimidiata* of authors as the only one to which the description can possibly apply. There remains only *B. hecticum*, which, although I treat it as a *species dubia*, has been compared with some form of *dimidiatum* by several writers, because of the almost perfect conformity of its description with that of our *dimidiata*. In fact, as noted above, its description is a better definition of *dimidiata* than the description of that shell itself. I am not willing to say that Linnaeus' *dimidiatum* is the *dimidiata* of authors, or that it is *hecticum*, or that it is *muscaria*. I do not think that anyone can, with any degree of confidence, assert that he has identified the species. In spite of this doubt, it would be unwise to change the name of the *dimidiata* of authors today, as it is so firmly fixed in the literature that unwarranted confusion would result. I have already said several times in this series of papers that the retention of disputed names, and even of names that have been proved incorrect, is offensive to one who sympathizes with those who insist on strict adherence to the principles that I feel should govern identification. I realize, however, that this is a minority opinion.

Dillwyn (1817, p. 650) was the first writer clearly to restrict the species to the *dimidiata* of authors. His citation of figures for his "typical" species are all correct and characteristic of that shell. The Lister figure, cited by Linnaeus in manuscript, and which is a dubious drawing, he allotted to his "Variety. Ferruginous, with obsolete white spots." The figures of *muscaria*, cited by Linnaeus, were omitted. His description gives a completely convincing picture of the *dimidiata* of authors.

Our *dimidiata* is figured by Chemnitz (1780–1795, vol. 4, pl. 154, fig. 1444) and by Reeve (1843–1878, vol. 12, *Terebra*, pl. 7, sp. 27). It is not figured in the "Tableau encyclopédique."

Its only certain synonym is *Terebra splendens* Deshayes, 1859, a pale form in which the yellow or orange background is broken up into squarish spots, instead of the typical pattern of white flammules on a yellow ground.

The species was not described in the "Museum Ulricae."

Buccinum murinum

1758, *Systema naturae*, ed. 10, p. 742, no. 421.

1767, *Systema naturae*, ed. 12, p. 1206, no. 488.

LOCALITY: "Ad Africam" (1758, 1767).

"B. testa turrita, anfractibus subangulatis, striis tribus muricatis . . . Testa nigra, basi gibba, anfractibus saepe basi alba."

This species must be left as undetermined. The synonymy consists of a single figure (Gualtieri, pl. 57, fig. P) which does not at all conform to the characters described. The description is, in fact, longer than most of the others in this group, but it is not possible to tie its details to any known *Terebra*, or to any other species.

Hanley (1855, pp. 263–264) described the Gualtieri drawing as showing "a livid and cancellated *Terebra*-like shell," a fairly accurate description, although the figure does not suggest any *Terebra* known to me. It does not, for instance, show the characteristic *Terebra* base. In any case it is not the *murinum* of the description, as the whorls shown are not angulated or provided with the three "striis muricatis" noted by Linnaeus.

There is evidence in Linnaeus' notes in his copy of the twelfth edition that he had intended to move the species to *Strombus* in his proposed "revised" edition, which suggested to Hanley that it might be a *Cerithium*, although there is only one species of *Cerithium* in *Strombus* Linné.

The name *murinum* was on Linnaeus' tenth-edition list of owned species, but not in his twelfth-edition list, which possibly indicates that he had lost his specimen or that he had based his description on a borrowed shell or on a description furnished by a colleague.

Hanley suggested that, of all the specimens in the collection, the only one that resembled the description of *murinum* was a specimen of *Cerithium granulatum* Bruguière, 1792, a shell that has a triple row of tubercles. This would be a reasonable suggestion if it were not for the fact that Linnaeus probably did not own the type of *murinum* at the time of his death, as it had been omitted from his last list, and the specimen of *C. granulatum* may have been added later, as we know that some additions to the collection were made while it was in the

possession of Sir James Smith. Moreover, the specimen does not answer to the coloring mentioned in the subdescription of *murinum*. Hanley concluded that, while the identity of *murinum* with *C. granulatum* "is not so improbable," it could not be proved.

Tryon (1879-1888, vol. 7, p. 39) suggested that the shell might be a *Triton*, but on what reasoning I do not know.

While most of the earlier post-Linnaean writers merely copied Linnaeus' description and synonymy, P. L. S. Müller (1773-1776, vol. 6, p. 473) gave a more expanded description: "Here the whorls are somewhat angular and the shell has three spiny ribs [*dornige Striche*]. It is black and the aperture expanded, and often the lower part of the whorl is white." It is readily seen that this is a mere paraphrase of the Linnaean description, and I question whether Müller had ever seen the shell he described.

The name has been dropped from the literature and is very properly regarded as standing for an undetermined species.

THE "MANTISSA" SPECIES IN *Buccinum* LINNÉ

Buccinum rugosum

1771, *Mantissa plantarum . . . regni animalis* appendix, p. 549.

LOCALITY: Not given.

"Testa ovata acuminata, cingulo tuberculoso, cauda prominente. *Bonan, recr. 3. t. 160*. Habitat . . . Testa magnitudine ovi, alba: striis transversis, elevatis, numerosissimis, confertissimis: quarum sexta (a suturi spirali) crassior, tuberculis constituens cingulum. Spira omnino ovata, acuta. Cauda exserta, leviter adscendens. Labrum marginatum, intus inaequaliter tuberculatum. Labium inferius late explanatum, in ipsa fauce inaequale. Crypta, inter testam et labium interius, profunda."

This name is fully discussed under *Buccinum echinophorum* (pp. 172-174, above). It is *Galeodea tyrrhena* (Gmelin) 1791, which Gmelin described as *Buccinum tyrrhenum*, borrowing the specific name from Chemnitz (1780-1795, vol. 10, p. 192). That *tyrrhenum* was the type of the *rugosum* of the "Mantissa" is demonstrated by the presence of a specimen of that shell in the Linnaean collection in London, marked by Linnaeus for *rugosum*. It was not described in the "Museum Ulricae."

The species is very close to *Galeodea echinophora* (Linné), and the student is again cautioned that both species are very variable in sculpture. The typical *echinophora* has four to six nodulose bands on the body whorl. There may be, however, as few as one such band. The species *tyrrhena* is typically lacking in nodules, although at times one or more rows of nodules are present.

The species is very graphically described in the "Mantissa." The name *tyrrhena* should be abandoned and the species known as *Galeodea rugosa* (Linné), 1771.

Buccinum monile

1771, *Mantissa plantarum . . . regni animalis* appendix, p. 550.

LOCALITY: Not given.

"Testa turrita anfractibus bifidis: inferiore sulcato, superiore moniliformi . . . Testa subulata albida seu flavescens: anfractus bifidi: inferior, latior, longitudinaliter obtuse sulcatus; superior angustus, ex catena nodulorum, dimidium monile referens."

This is an unidentified species. Although the description is long and apparently perfectly clear, the particular combination of characters listed cannot be applied to any single species. A few of the early followers of Linnaeus mentioned *monile* but only by copying or paraphrasing Linnaeus' description and with an admission, expressed or implied, that they had not seen the species.

Gmelin (1791, p. 3505) repeated Linnaeus' main description and the first clause of the subdescription relating to shape and color, but referred only to the "Mantissa" and omitted the locality, as did Linnaeus. The name was listed by him at the end of his genus *Buccinum* along with *proximatum*, *cingulatum*, and *gemicum*—all "Mantissa" species.

Dillwyn (1817, p. 645) also listed it, with an almost exact English translation of Linnaeus' main description, referred to the "Mantissa" and to Gmelin's mention of the species, and said: "Linnaeus, who alone had noticed this species, says that it is subulate, white or yellowish, with a transverse row of nodules on the upper division of the whorls, which is narrowest, and the lower division grooved longitudinally. Linnaeus, on the same page of the 'Mantissa,' has given two almost exactly similar descriptions of this

species." He also grouped *monile* with the other *Terebra* species in *Buccinum*. As to Dillwyn's last sentence, there is no other description on page 550 of the "Mantissa" that can be called "almost exactly similar" to that of *monile*, as none of them mentions a moniliform band on the whorls or any expression of similar meaning.

Lamarck did not refer to *monile*, nor did Deshayes and Milne-Edwards, the editors of his second edition.

Hanley (1855, p. 456) noted that Linnaeus, in his manuscript notes for his proposed "revised twelfth edition," grouped *monile*, *gemicum*, and *proximatum*, the three "Mantissa" species that are probably terebras, immediately after *hecticum*, and said that all three were members either of the genus *Bullia* or of *Terebra*, but that none of the three could be recognized by the characters furnished in their descriptions. As none of the *Bullia* species can be described as "*subulata*," a word used in the descriptions of all three of the shells in question, it seems obvious that none of them were in that genus.

Menke (1830, p. 30) listed, but did not describe, a *Terebra monilis*, which he referred to *B. monile* Linné.

Deshayes (1859, p. 319), in his "General review of the genus *Terebra*," listed the species as a name that had been used and said, "Unfortunately, the too short description of this species leaves it among the indeterminate species." The description is, of course, rather long and comprehensive, although not applicable to any *Terebra* I have seen.

I have found no further reference to the name until Tryon (1879-1888, vol. 7, p. 39) said that, while *monile* was specifically undeterminable, it, with its two companion species in the "Mantissa" (*gemicum* and *proximatum*), was probably a terebra. Since then the name seems to have completely dropped out of the literature, and I am unable to make any reasonable suggestion as to its identity.

Buccinum gemicum

1771, Mantissa plantarum . . . regni animalis appendix, p. 550.

LOCALITY: Not given.

"Testa turrita, anfractibus bifidis, substriata superiore protuberantiore . . . Testa subulata, alba. Anfractus bifidi: inferior latior, transver-

saliter obsolete striatus: stria superiore crassiore. Anfr. superior angustus, sed magis elevatus, laevis, obtusus; primo intuitu videntur cingula quasi ex duplici filo convoluta."

All that is said above about *Buccinum monile* can be repeated for this species. The treatment by Gmelin (1791, p. 3506) and Dillwyn (1817, p. 645) is to the same effect as their treatment of the preceding species, except that both authors listed this as "*geminum*." Deshayes (1859, p. 318) also dismissed it as indeterminable, and Tryon (1879-1888, vol. 7, p. 39) merely classed it with *monile* as probably a *Terebra*.

I have searched in vain for a specimen or figure of any *Terebra* that even approaches the characters mentioned in the description of *gemicum* and can add nothing to the accepted opinion that the species is to be left as unidentified.

Buccinum cingulatum

1771, Mantissa plantarum . . . regni animalis appendix, p. 550.

LOCALITY: "In Islandia" (1771).

"Cingulis tribus elevatis supra infraque canaliculatis . . . Testa magnitudine pruni minoris, ovata, cinerea, transverse striata: ventrem cingunt cingula 3, spiram 2. Cingula haec maxime elevata, laevia, extus latiora seu utrinque canaliculata. Anfractus supra planiusculi. Apertura obovata: columella planiuscula. Murici Doliario proxima."

This is the *Thais cingulata* of modern authors.

That this species, with its peculiar and distinctive sculpture of heavy, revolving, cord-like ribs, which was so precisely and fully described by Linnaeus, should not have been immediately referred to the *Buccinum cingulatum* of the "Mantissa" is largely if not entirely accounted for by the fact that the "Mantissa plantarum" was apparently not known to, or at least not consulted by, the early zoologists.

¹ Linnaeus, possibly owing to an oversight, described *B. cingulatum* twice in the "Mantissa." The second description (p. 549) is a mere paraphrase of that on page 550, quoted above, the only added matter being a description of the lip ("Labrum sub cingulis plicatum") and a question mark after the word "*Buccinum*." The locality, the name of the collector, Koenig, and the comparison with *Murex doliarium* are identical. There is no question but that the two descriptions refer to the same species, though Linnaeus may have thought he was describing two varieties.

Although Linnaeus supplied no synonymy, good figures of the species were available to him in Lister (pl. 1059, fig. 2), Petiver (pl. 101, fig. 14), and Knorr (pt. 3, pl. 7, fig. 2). The shell, in spite of the remoteness of its range, was apparently well known to the early conchologists. Linnaeus' specimen was supplied to him by his pupil D. Koenig and the stated locality, Iceland, was probably vouched for by Koenig, although I have not seen the species reported from northern waters, its home being the Cape of Good Hope and the Strait of Magellan. Linnaeus' comparison of the species with *Murex doliarium* (*Cabestana doliaria*) is considerably overdrawn, as the ribs of that species are always more numerous than in the typical *cingulata*, are sharper, and are tuberculate by the crossing of prominent longitudinal threads.

The species is very variable in the number of its revolving cords. The usual number, and the number on the specimen described by Linnaeus, is three, but individuals with only one or two cords and even with four to eight are fairly common.

The earliest post-Linnaean reference to the species was that of Davila (1767–[1785], vol. 1, p. 143, pl. 8, fig. 5), which was four years before the publication of the "Mantissa." Davila called it only by its French vernacular name, "le Cabestan," the capstan. In his text he spoke of "Two extremely rare Buccins" one of which had three ribs and the other two.

The next mention of the species was by Martini in 1777 (1769–1777, vol. 3, p. 411, pl. 118, figs. 1089a, b) who called it *Dolium tricarinatum*, *Trochlea dictum*. His figures show the typical or most common form with three cords on the body whorl, from which feature he derived the name. He erroneously located it in the East Indies.

Schröter (1783–1786, vol. 1, p. 360, pl. 2, figs. 8a, b) did not give the shell a name but called it merely "Buccinum No. 15" and gave it four ribs, which are shown in the figure. His "Buccinum No. 16" (*loc. cit.*), which is not figured, is described as having three.

Bruguère (1789, 1792, pp. 248–249) gave the species the specific name *trochlea*, probably borrowed from Davila, and left it in *Buccinum*. He cited the Petiver, Knorr,

Davila, and Martini figures referred to above, together with a new figure from Favanne (pl. 34, fig. E) and the four-ribbed Schröter figure, the latter of which is an excellent drawing. He mentioned that the shell had been a rarity, but "is so no longer since it has been discovered on the shores of the Cape of Good Hope." His description is one of the best diagnoses of this species in the literature. It refers to the variability in the number of ribs: "The form of which M. Schröter has given us a figure has four; I have seen a specimen in the cabinet of M. de Joubert which has only two, and I own an example whose two lower ribs are united in a single one."

Gmelin (1791, pp. 3485, 3506) listed the species twice under different names, unaware that he was dealing merely with two varieties of the same shell. On page 3485 he described a four-ribbed shell in the words "primo costis quatuor glabris," calling it *Buccinum scala*. That it was the same shell described by his predecessors Martini, Schröter, and Bruguère is evidenced by his citation of most of the figures in the earlier synonymies. He gave no locality. On page 3506 he again described it as a three-ribbed form with the Linnaean name *Buccinum cingulatum*, and referred it to the "Mantissa" species, with no further references and paraphrasing Linnaeus' language very closely. He used the Iceland locality given by Linnaeus. This represents the first identification of the "Mantissa" species that I have found.

Dillwyn (1817, p. 619) reverted to Gmelin's first name *scala*, but described three varieties: variety A, a four-ribbed shell, for which he cited Gmelin's *scala* and the Schröter reference to "Buccinum No. 15"; variety B, a three-ribbed form, for which was cited the "Mantissa" reference, Bruguère's *trochlea*, Schröter's "Buccinum No. 16," and the earlier figures from Lister, Knorr, Davila, and Martini; variety C, with two ribs, citing the Favanne figure. He gave all the localities used by the earlier writers, the "East Indies" of Martini, "Strait of Magellan and Cape of Good Hope" of Bruguère, and even "Maryland" from the "e Marilandia" of Lister, which latter he quoted with a question mark.

Lamarck (1822, vol. 7, p. 241) restored the

name *trochlea* to the species and included it in the genus *Purpura* Bruguière, 1789.¹ He described the three-ribbed form but did not refer to Linnaeus' *cingulata*.

Deshayes and Milne-Edwards (1835–1845, vol. 10, pp. 86–87), in their second edition of Lamarck's work, did refer the species to the *cingulata* of the "Mantissa" and were the first to recommend the reinstatement of that name. They also apparently considered the variously sculptured forms as conspecific, as, although their description mentions only three ribs on the body whorl, the references in the synonymy include two-, three-, and four-ribbed shells. A footnote says: "The *Mantissa* of Linné, a work little consulted by zoologists, contains, at the place cited, a very exact description of two varieties of this species: as this name is earliest and moreover comes from Linné, it should be restored to the species, which would become *Purpura cingulata*."

Two years later, Reeve (1843–1878, vol. 3, *Purpura*, pl. 13, sp. 76) listed the species as *Purpura cingulata* Linné, giving the *Buccinum cingulatum* of the "Mantissa" as a synonym. This appears to be the first application of the change advocated by Deshayes and Milne-Edwards. Reeve proposed, however, to restrict the name *cingulata* to the typical form having three ribs, and described the form with five ribs as *Purpura spirilis*. This limitation of the species has not been adopted by most of the later conchologists. Tryon (1879–1888, vol. 2, p. 169, pl. 51, figs. 108, 110, 111, 114–117) referred to and disagreed with Reeve's restriction, saying: "I have before me a series including specimens with from one to eight ribs, and in some of which the ribs become obsolete and replaced by deep striae; even the shoulder of the whorls disappears and then we have the form, the young of which is described by Krause as *P.*

cribrosa (fig. 111)." The form *spirilis* of Reeve is shown in Tryon's figure 114.

Hanley's examination of the Linnaean collection in London in the years immediately preceding 1855 entirely confirmed the now accepted identification, as he found a specimen of what he then called *Purpura trochlea* in a box marked for *Buccinum cingulatum* in the collection (Hanley, 1855, p. 456). Since his day the name *cingulata* has been increasingly employed, although some continental conchologists retained *trochlea*.

In addition to the figures cited above, the species is well figured in the "Tableau encyclopédique" (pl. 422, figs. 4a, b) and by Maxwell Smith (1953, pl. 18, fig. 21), both figures showing the typical three-ribbed form. A comparison of the "Tableau" figures with the drawing of "*Triton*" *dolarium* (fig. 7) on the same plate is instructive as showing the great difference in the sculpture of the latter species which Linnaeus said was "proxima" in his description of *B. cingulatum*.

The present species has been included in the genus *Thais* Röding, 1798, subgenus *Trochia* Swainson, 1840, since the "Museum Boltenianum" of Röding came to the renewed attention of conchologists in 1906, although it still appears in *Purpura* in unrevised collections, and the latter name is still used by some workers who are slow to acknowledge the wisdom of Opinion 96 of the Commission that the "Museum Boltenianum" is "nomenclatorily available" or who question the interpretation of the word "available."

Synonyms are *Buccinum trochlea* Bruguière, 1789; *B. scala* Gmelin, 1791; *Murex planatus* of the "Museum Geversianum," fide Dillwyn; *Purpura spirilis* Reeve, 1846; and *P. cribrosa* Krause.

The species is not described in the "Museum Ulricae."

Buccinum proximum

1771, *Mantissa plantarum . . . regni animalis* appendix, p. 550.

LOCALITY: Not given.

"Testa turrita, anfractibus bifidis; inferiore substriato, superiore filiformi . . . Testa subulata, nitida. Anfractus bifidi. Anfractus inferior latior, transversaliter obsolete striatus. Anfractus superior filiformis, elevatior; primo intuitu videntur anfractus simplices, superne stria elevata, obtusa, gemina."

¹ *Purpura* Bruguière 1789, has not yet been officially accepted as a valid generic name as the International Commission on Zoological Nomenclature has ruled, in Opinion 74, that Apstein's 1915 list of *nomina conservanda* (including *Purpura* Bruguière) cannot be accepted *in toto*, but that each name must be ruled on separately on consideration of a proper application. If this name should be rejected, the next available name would be *Haustorium* Perry, 1811, with *H. zealandicum* Perry as type species. This is not *Purpura* Bruguière, 1792 (see p. 200 above).

This also is an undetermined species. What has been said of *B. monile* and *gemicum*, above, applies equally to this species. Gmelin and Dillwyn both listed it, but merely copied or translated the Linnaean description, and Dillwyn (1817, p. 645) said, "No subsequent author has ascertained this species. . . ." Tryon included it in his list of undetermined terebras. I can offer no further suggestion as to its identity except to say that it is undoubtedly a *Terebra*. The description points out many characters that it has in common with *gemicum*.

The following species, placed in *Buccinum* in the tenth edition, were moved in the twelfth edition to the genera indicated:

TENTH EDITION

Buccinum virgineum, no. 407
Buccinum scabriculum, no. 412

STOMBUS LINNÉ

In the tenth edition of the "Systema naturae" the genus *Strombus* included 22 species. Seven more were added in the twelfth, two of which had been transferred from other genera—*fusus* from *Murex* and *spinosus* from *Conus*. The "Mantissa" provided two more, making a total of 31 names. These are today distributed among 10 different genera, one species being here treated as a *species dubia*. It may nevertheless be said that *Strombus* Linné is a much less heterogeneous group than are several other of the Linnaean genera, as 17 of the 30 identified species are still retained in *Strombus* as now restricted. This is a very large proportion when compared with the present distribution of the contents of some of the genera already discussed, notably *Venus*, *Bulla*, *Voluta*, and *Buccinum*. The remaining 13 species are, it is true, widely scattered among genera most of which are far removed from *Strombus* as now conceived, and in some cases in other families. *Tibia* Röding accounts for three, *Lambis* Röding for four, *Aporrhais* Da Costa, *Morum* Röding, *Cerithium* Bruguière, *Terebralia* Swainson, *Faunus* Montfort, and *Volutospina* Newton, for one each. Thus the Linnaean genus is sharply divided into two groups: one with *Strombus*, *Tibia*, and *Lambis*, which are included in the family Strombidae, and the

other a heterogeneous group of species, most of which have little phylogenetic affinity with that family.

The early breaking up of *Strombus* Linné by Bruguière, Röding, Montfort, and Lamarck has produced a classification that has since remained fairly stable. The most radical departure from the classifications of these early writers was that of Link (1807, pp. 107, 109, 129), whose arrangement has not been followed. Fifteen of Linnaeus' 17 species of the restricted *Strombus* were placed by Link in the genus *Lambis* Röding, as that genus was conceived by him. *Strombus lambis* Linné itself, from which we must assume that Röding derived his new generic name *Lambis*,

TWELFTH EDITION

Bulla virginea, no. 390
Voluta scabricula, no. 417

was placed by Link not in *Lambis*, but in *Pteroceras* (*sic*) Lamarck, 1799, along with *pes-pelecani*, *chiragra*, and *millepeda* Linné. He did not list *scorpius* Linné. Link's peculiarly conceived *Strombus* contained only five species: a *S. gibbosus*, which resembles a *Cerithium* according to the figures he cited, two of the murices of Gmelin, *plicatulus* and *nodulosus*, a shell that he called *Strombus turritus*, which he said was "close to *Cerithium aluco* Linné," and *Strombus ater* Linné.

In general the descriptions in the *Strombus* of the "Systema" are brief, and in several cases omit important diagnostic features of the shells. Many of these cases are assisted by good synonymies, however, and a very large proportion of the species are represented by fully documented types in the Linnaean collection in London.

Strombus fusus

1758, Systema naturae, ed. 10, p. 752, no. 478 (in *Murex*).

1767, Systema naturae, ed. 12, p. 1207, no. 489 (in *Strombus*).

LOCALITY: "In O. Americano" (1758); "in America, rarior" (1767).

"S. testa turrita laevi, cauda subulata, labro dentato . . . Genus hujus difficile determinatur. Testa laevi a Muricibus omnino differt; Cauda magis recta a Strombis aliquatenus recedit, sed labro dentato convenit."

The main description in the twelfth edition was the same as that in the tenth edition except that the "recto-caudata" of the tenth was changed to "cauda subulata." The entire subdescription was added in the twelfth.

In 1799 Lamarck erected the genus *Rostellaria*, with *Strombus fusus* Linné as its type, by monotypy, and in 1822 (vol. 7, pp. 192-194) he described several species, two of which were *R. curvirostris* and *R. rectirostris*. For the first he referred to the *S. fusus* of Linnaeus, and this identification was accepted by many of his followers, although from Deshayes and Milne-Edwards onward an identification with *rectirostris* was increasingly used. The evidence in favor of Lamarck's view is presented below, as a part of the history of the two names.

Rostellaria rectirostris is a slender shell, the anterior canal of which is produced into a beak more than one-third as long as the entire shell. The aperture is small and round and dentate along the entire length of the outer margin. The base of the body whorl shows a series of deeply incised spiral lines. The lower whorls of the spire are smooth and the upper whorls longitudinally and strongly plicate.

Rostellaria curvirostris is a much stouter shell, the sides of which slope at a much greater angle from the vertical, so that it increases in width much more rapidly, the body whorl being almost twice as broad as that in *rectirostris*. The aperture is therefore wider and longer. The lip is dentate only on its lower third. The sculpture parallels that of *rectirostris*, except that it is less developed both as to the spire and to the incised lines of the body whorl. The anterior canal or "beak" is approximately half as long as the beak in *rectirostris*, or about one-sixth of the entire shell.

In describing *curvirostris* one should point out that care must be taken in interpreting the words "recto" and "subulato" in the two "Systema" descriptions of the beak of *fusus* and the antithetical words "curvo" and "rectissimo" of the two Lamarckian species. Lamarck used "curvo" for *curvirostris*, but the beak of that species may be perfectly straight and in the axis of the shell, or may be obliquely bent to the right but still straight, or may be, and in the majority of specimens is, curved to the right. Note that it may be

bent to the right but not curved. It is, however, always short, but there is great variation in its direction and curvature. Therefore "curvo" should not have been used by Lamarck as applying to the species as a general term. There are specimens of *curvirostris*, for instance, for which the word "rectissimo" in the description of *rectirostris* might be used. Again, it might be argued that Linnaeus, in changing from "recta" to "subulata" between the two editions of the "Systema," was effecting no change of meaning, as a straight member may, of course, be subulate. On the other hand, the present writer is impressed with the idea that a curved member may be subulate as well. Certainly there are instruments, such as a surgical needle, which are so shaped. These points are suggested as I feel that much of the confusion between the two species and the application of either to *fusus* Linné, as well as the suspicion that the *fusus* of the "Museum Ulricae" may not have been the same as the *fusus* of the "Systema," may have been caused by a misapplication of the words quoted above, or by a failure to examine a sufficiently large series of *curvirostris*.

The tenth-edition description of *fusus*, therefore, can be said to cover either of Lamarck's species, if it was based on a straight or straight-and-obliquely-bent specimen. In the same way, the twelfth-edition description, with its "cauda subulata" and "recta," could be said to describe either. We know that Linnaeus did not own a specimen of *fusus* in 1758, as the name does not appear on the tenth-edition list. He must have acquired a specimen later, as one is present in his collection now in London. The significant fact is that this specimen, which is marked for *fusus* in the handwriting of Linnaeus, is *curvirostris* Lamarck, the short-beaked and broader shell. Whatever may be our opinion as to the clarity of a given Linnaean description or a Linnaean synonymy, or whatever relative weight may be given to either, the final test of the identity of a species is supplied by the presence of the undoubted type specimen in the Linnaean collection, documented by Linnaeus' own hand. It may be that Linnaeus at first conceived of *curvirostris* as a variety of the rare shell with the long anterior canal. This is very unlikely,

however, as the two species cannot be mistaken one for the other, and Linnaeus himself said that his *fusus* was "rarior, distinctissima." In any event he knew in 1767, or possibly later, that *curvirostris* was a distinct species and placed it in his collection as the type of *fusus*.

Linnaeus' synonymies are inconclusive. In the tenth edition he cited three figures: Buonanni (pl. 121), Argenville (1742, pl. 13, fig. D), and Klein (pl. 4, fig. 77). All three show a narrow, fusiform shell with a long and perfectly straight anterior canal that is more than one-third as long as the entire shell and with an aperture that is small, patulous, and round, and provided with blunt teeth or scallops along the entire lip margin. These figures were unquestionably based on the shell later called *rectirostris*. In spite of the equivocal description, therefore, it seems evident that Linnaeus' 1758 *fusus* must have been the long-beaked species. In the twelfth edition Linnaeus added a group of three more figures (Seba, pl. 62, figs. 1-3). These are also clearly drawn and unquestionably show *curvirostris*. Hanley (1855, pp. 264-265) referred to these synonymies as follows: "It was pictorially defined in the tenth edition by no less than three figures of the short-tailed form of *Rostellaria rectirostris*, a shell whose characters, being in harmony with the description, must consequently reassume, as Deshayes has remarked, the appellation originally bestowed upon it by Linnaeus. . . . In the twelfth edition of the 'Systema,' Linnaeus unfortunately quoted, in addition to that figure in Seba which represented the shell he had previously indicated, two others in the same work, both usually referred to the *R. curvirostris*, though one of them looks more like an immature *R. curta*. From this circumstance arose the common acceptance of the first-named shell as the representative of the Linnaean species. Dillwyn perceived this error, for he has solely referred to the 'Museum Ulricae' and the tenth edition of the 'Systema,' in the synonymy of his *S. unicornis* (*R. rectirostris* of Lamarck), but, from deference to the opinion of others, has unwisely continued the name *fusus* to the *curvirostris*." When the complexities of Hanley's involved language have been unraveled, his errors in

reporting corrected, and his misleading punctuation clarified, we are still left with his flat statement that the entire tenth-edition synonymy covered "*the short-tailed form of rectirostris*" (italics mine). There is no such form of that species, although in some cases specimens with broken beaks have caused the shells to be so designated or even to be identified with *curvirostris*. The entire synonymy of *fusus* in the tenth edition shows the typical *rectirostris*.

In the "Museum Ulricae" Linnaeus first copied the tenth-edition description and confined his synonymy to the figure from Argenville cited in that edition which showed *rectirostris*. His additional description contains two details that have been said to point to *rectirostris*. The first is "Apertura . . . antice lacunosa." Even when Linnaeus' habitual error in using "antice" for "postice" is corrected, the phrase is still not clear, unless by "lacunosa" he meant the sinus between the uppermost tooth on the lip and the short posterior canal which is formed by the meeting of the outer lip and columella. This is not only a far-fetched conclusion, but "lacunosa," which means "full of hollows or gaps," is hardly the word to apply to a single sinus. The other phrase is "Rostrum baseos rectum, testa dimidio brevius." The word "rectum" could refer to either the long-beaked or short-beaked shell, as said above. The remainder of the phrase, if it is to be translated as "half as short as the shell," would refer to a beak longer than even that in *rectirostris*. It is clumsy Latin, however, and it is not understood why Linnaeus used this word for "short" instead of "long." The curious locution makes one hesitate to say that he was attempting to describe the long-beaked species. The remainder of the description might cover either *rectirostris* or *curvirostris*.

In the last analysis, therefore, I can see nothing in any of Linnaeus' three descriptions that permits us to say that the language points to one of the two species exclusively. In the case of the synonymies the situation is equally confused. That in the tenth edition points to *rectirostris*. Three figures from Seba in the twelfth were probably based on *curvirostris*, but I question whether Linnaeus

added these because he had changed his mind as to his *fuscus*. There is no evidence that he was familiar with both species. He did not own a specimen of either in 1758 or, in all probability, even in 1767. It is suggested that he relied on the pre-Linnaean figures alone and thus conceived them to be forms of a single species. This seems strange to us, who are familiar with the two dissimilar shells, but is understandable in the case of Linnaeus. None of the figures he cited is completely unequivocal, and some show sufficient similarity with both species to have deceived him. I do not believe, as some have, that Linnaeus suffered a change in his conception of his *fuscus* in the course of his three treatments of the name.

This discordance in the synonymies was referred to by Deshayes and Milne-Edwards (1835-1845, vol. 9, pp. 653-654, footnote) who said: "To his first synonymy, Linné, in the twelfth edition of the 'Systema,' added three figures from Seba, two of which belong to *Rostellaria curvirostris*; but one feels that such an unimportant error should not determine the union of *Strombus fuscus* to *curvirostris*; it is merely necessary to rectify the synonymy of Linné, and identify his *Murex fuscus* or his *Strombus fuscus*, which is the same species, to *Rostellaria rectirostris* Lamarck." I have already called attention to Hanley's statement that Linnaeus "unfortunately quoted" the Seba figures in the twelfth edition. To that statement he added: "From this circumstance arose the common acceptance of the first-named shell [*curvirostris*] as the representative of the Linnaean species."

When the high points of the diverse treatments of *fuscus* are taken up in chronological sequence, it is seen that the confusion began as early as Chemnitz, in 1780. He supplied the classic figures of both *rectirostris* and *curvirostris*, figures that can hardly be improved upon. The short-beaked *curvirostris* was called "Turbo seu fuscus magnus crassus. . ." (1780-1795, vol. 4, pp. 331-335, pl. 158, figs. 1495-1496) and was specifically referred to *Strombus fuscus* Linné of the twelfth edition alone. The long-beaked *rectirostris* (*tom. cit.*, pp. 338-342, pl. 159, fig. 1500 and vignette 41, p. 344) was called "Turbo rostratus seu fuscus dentatus" and was referred

to *Strombus fuscus* Linné of both the tenth and twelfth editions and the "Museum Ulricae." Chemnitz' figure 1497 (*tom. cit.*, p. 336, pl. 158) shows an immature *curvirostris* or possibly *Rostellaria curta* Sowerby, 1842,¹ and was appropriately called "Turbo seu Fuscus absque dentibus oris." It was not referred to any of the descriptions of *fuscus* Linné, but Chemnitz cited for it the Seba figure 3 which Linnaeus had cited for *fuscus* in the twelfth edition. This figure shows an immature shell which I have tentatively identified with *curvirostris*. Hanley thought it resembled the immature *R. curta* Sowerby. Thus Chemnitz referred the short-beaked shell to the twelfth edition alone, while both editions and the "Museum Ulricae" were cited for the other, a treatment that leaves us unable to guess at his interpretation of the two shells, as applied to *fuscus* Linné. His two entirely different figures are both referred to the twelfth-edition *fuscus*.

Gmelin (1791, p. 3506) evidently accepted the confusion in Linnaeus' synonymies as indicating that *rectirostris* and *curvirostris* were conspecific, as he uses figures of both species for his three varieties of *fuscus*. This is unexplainable, as some of the new figures he cited clearly show the difference between the two. Thus, for his main variety he cited Chemnitz' figures 1495 and 1496 of *curvirostris*, and for his variety "γ" the Chemnitz figure 1500 of *rectirostris*. For his variety "β" he cited the Chemnitz figure of the immature *Rostellaria* (fig. 1497).

Lamarck (1801, p. 81) gave *R. subulata* as his "example" of the genus. This was undoubtedly a new name for Linnaeus' *fuscus*. The references given for this name are as discordant as those in the "Systema." Of the four figures quoted, two (1742, Argenville, pl. 13, fig. D, and Chemnitz, pl. 159, fig. 1500)

¹ Sowerby's *curta* is a shell identical with *curvirostris* in most characters except that the outer lip is dentate over a greater portion of its margin. It has a straight and undeflected beak, and has been called by several writers a subspecies of *curvirostris*. Deshayes and Milne-Edwards (*tom. cit.*, p. 663, footnote) distinguished it from *curvirostris* in several respects, their principal argument being that it had a straight beak of approximately the same length as in that species. I have already noted that *curvirostris* may have a straight or curved beak.

unquestionably show the long-beaked species *rectirostris*. One (Lister, pl. 854, fig. 11) is just as clearly *curvirostris*. The fourth (Lister, pl. 916, fig. 9) is probably *rectirostris*. The preponderance of figures of *rectirostris* in this synonymy may indicate that Lamarck's original conception of *fuscus* was later changed, in 1822, when he assigned *fuscus* to the short-beaked shell, unless he chose the figures carelessly, as did Linnaeus.

Dillwyn (1817, pp. 654-655) described *fuscus* Linné as having "an obliquely curved beak," thus definitely identifying it with Lamarck's *curvirostris*. Note, however, that he referred only to the twelfth edition of the "Systema." His next species, *Strombus unicornis*, was described as having a "long straight beak," which, with his reference to the Chemnitz figure 1500, ties *unicornis* to *rectirostris*. For *unicornis* he referred only to the tenth edition of the "Systema" and the "Museum Ulricae." This limitation of *fuscus* to the *fuscus* of the tenth edition of the "Systema" called forth the remark of Hanley (quoted on p. 240, above) that Dillwyn had "unwisely continued the name *fuscus* to the *curvirostris*." I agree with Dillwyn's identification of *fuscus* but am unwilling to adopt the view that Linnaeus had described two different shells in the three words involved. Dillwyn's *unicornis* is defined so precisely, and his synonymy is so complete and accurate, that it is unfortunate that it cannot replace *rectirostris* as the earliest name for the long-beaked species. The present attitude of the majority of conchologists is that "stability" in the nomenclature is more to be desired than a strict adherence to the Rule of Priority, an attitude that is apparently held today by the Commission on Zoological Nomenclature.

Lamarck (1822, vol. 7, p. 192) described *curvirostris* and *rectirostris* with great accuracy, except for the misleading word "curvo" for the former species, and identified *fuscus* Linné with his *curvirostris*. The Chemnitz figures of the short-beaked shell are cited for *curvirostris* and of the long-beaked species for *rectirostris*. Linnaeus' *Strombus clavus* of the "Mantissa" (see the discussion of *clavus*, p. 299, below), as *Strombus clavus* Gmelin, is cited in the synonymy of *rectirostris*, although there is considerable doubt in my mind as to the species of which *clavus* was the juvenile

shell. Dillwyn also cited *clavus*, specifying that it was the "junior" shell of *rectirostris*, and referred it to the *clavus* of the "Mantissa."¹

Thus far the principal writers identified *fuscus* with the short-beaked *curvirostris*. As shown above (p. 241) Deshayes and Milne-Edwards took the opposite view, their opinion being based principally on the synonymies of Linnaeus and their explanation of the three figures of *curvirostris* in the twelfth-edition synonymy as a "faible erreur." They did not discuss the three Linnaean descriptions.

It is quite apparent from a reading of Hanley's comments on this question that he agreed with Deshayes and Milne-Edwards. He admitted that there was a specimen of *curvirostris* in the Linnaean collection in London, marked by Linnaeus for *fuscus*, but attempted to explain this specimen away by an argument that is not only fallacious but is a mere rationalization of an unwelcome fact. He said: "In the 'Mantissa' our author has bestowed the name of *Strombus clavus* upon an immature example of *R. rectirostris*. Having possibly perceived its identity with his previously constituted species, Linnaeus perhaps intended to conceal the double appellation, by transferring the name *fuscus* from his earlier species to the *R. curvirostris*, which latter he has thus described at large in his revised copy, and eventually marked for the species in his own collection" (italics mine).

In order to emphasize Linnaeus' undoubted choice of the short-beaked shell as the representative of his *fuscus*, I am setting out in full the description mentioned by Hanley, which is found as a manuscript note in Linnaeus' own "revised" copy of the twelfth edition:

"Testa fusiformi, subulata, pallide testacea, laeviuscula; anfractus breves, praeter apicem anfractus 5 seu 6, longitudinaliter, seu ad suturam, crenati. Faux ovato-lanceolata, alba glaberrima, utrinque excurrens in canalum; canalis anterior [*sic*] lanceolatus, adnatus, excurrens tertium anfractum; posterior [*sic*] subulatus, longitudine vix aperturae, sinu oblongo distinctus a labis exteriore, margine

¹ I do not recall a single instance in which Lamarck cited the "Mantissa." He was either ignorant of its existence or preferred to cite the Linnaean species as "Gmel." or "Lin. Gmel," as he also nowhere mentions either edition of the "Systema."

nigro; labium exterius gibboso-marginatum, *postice* [sic] *dentibus* 5 seu 6 obtusis glabris; *posterioribus* [sic] *majoribus*. Labium interius reflexum gibbum, dente gibboso in fauce ad canalis anterioris initium" (italics mine).¹

While this description was never published, it represents, I am convinced, a clarification of Linnaeus' original vague descriptions rather than a change in his concept of the species. In any case, the presence of the documented type in the collection must be controlling.

Two other remarks of Hanley should be noted. He said (*loc. cit.*), "The more ample details in the 'Museum Ulricae' exactly apply to the only drawing there cited as illustrative, to wit, Argenville's representation of the above named *Rostellaria* [*rectirostris*]." As already stated I question this interpretation of that description. Hanley further said: "Should the long-tailed Chinese variety be hereafter reputed a distinct species it is worth remembering that the 'rostrum testae dimidio brevius' (M.U.) would not so fittingly apply to that form as to the other. The shortness, however, was, perhaps, after all, only the result of accident." In speaking of the "long-tailed Chinese variety" Hanley was comparing it with the "short-tailed form of *Rostellaria rectirostris*," which he had already mentioned and which does not exist. The mention of an accident is possibly the explanation of his error and also possibly explains the quoted words from the "Museum Ulricae" that I discuss above.

From Hanley onward most writers have followed the opinion of Deshayes and Milne-Edwards and of Hanley. To name but two: Reeve (1843-1878, vol. 6, *Rostellaria*, pl. 1, sp. 2) referred *curvirostris* to Lamarck, with no mention of *fuscus* Linné. His figure shows the stout, coniform shell with the short and slightly curved beak. His figures 5a, b, and 7 on plate 2 show the long-beaked shell and are referred to *Rostellaria fuscus* "Deshayes," *Strombus unicornis* Dillwyn, *Rostellaria subulata* Schumacher, *R. rectirostris* Lamarck, and *Strombus clavus* Gmelin, and are called

¹ In every case in which "posterior" or "anterior" or their derivatives are used in the above description, their meanings are reversed. This is proved not only by the context, but by the fact that this error is habitual with Linnaeus throughout his writings.

Strombus fuscus Linné. Tryon (1879-1888, vol. 7, p. 128, pl. 10, fig. 17, pl. 11, fig. 21) described and figured *Rostellaria fuscus* Linné as the long-beaked shell, and synonymized it with *R. rectirostris* Lamarck, *R. subulata* Schumacher, and *R. unicornis* Dillwyn.

Cossmann (1903, p. 165) also refers to Tryon's figure 17 as *Rostellaria fuscus* Linné, and his own figures for *fuscus* show dorsal and apertural aspects of a fossil *Rostellaria* with a broken anterior canal, the other features of which are those of an immature *rectirostris*.

Sowerby (1847-1887, vol. 1, p. 21) possibly identified *fuscus* Linné with *curvirostris*, although he lists it as *fuscus* Gmelin, with no mention of Linnaeus. This reflects the peculiar synonymy of Gmelin's *fuscus*, who, as mentioned above, included both *rectirostris* and *curvirostris* as forms of the same species.

Both of the Lamarckian species are now included in the genus *Tibia* Röding, 1798, of which *S. fuscus* Linné, under the name of *Tibia insulae chorab*, is the type species, by subsequent designation, Dall, 1906a. This designation was confirmed by Winckworth (1954b, p. 144). In addition to *Rostellaria* Lamarck, *Rostellum* Montfort, 1810, and *Gladius* (Klein) H. and A. Adams, 1854, are synonyms of *Tibia* Röding. *Rostellaria* is still used to some extent by continental writers and is seen in this country in unrevised collections.

Synonyms of the specific name *fuscus* Linné, which refers to the *curvirostris* of Lamarck, are *Alata fuscus* Meuschen, of the "Museum Geversianum," 1787; *Fusus ventricosus* Humphrey, of the "Museum Calonnianum," 1797; *Tibia insulae-chorab* Röding, 1798; *Rostellum ternatarium* Montfort, 1810; *Rostellaria dentata* Perry, 1811; *Rostellaria brevirostra* Schumacher, 1817; and *Rostellaria luteostoma* Angas, 1878.²

Synonyms of *Strombus unicornis* Dillwyn are *Alata lacuna* Meuschen, of the "Museum Geversianum," 1787; *Fusus longirostrata*

² Montfort's synonymy for his *R. ternatarium* includes all the clearly recognizable figures and references to the long-beaked species *rectirostris*, including Chemnitz' fine figure 1500, and the Argenville and Buonanni figures cited by Linnaeus. His description might cover either the long- or the short-beaked shells, but is possibly more descriptive of the long-beaked. His own figure, on the other hand, is definitely *curvirostris* (*fuscus* Linné).

Humphrey, of the "Museum Calonnianum," 1797; *Tibia indianarum* and *clavus* Röding, 1798; and *Rostellaria rectirostris* Lamarck, 1822.

The specimen marked for *fuscus* in the Linnaean collection in London is Lamarck's *curvirostris*, a specimen with a short and perfectly straight beak, with no hint of a curve, and only barely directed obliquely to the right.

The specimen now labeled *Murex fuscus* in the Uppsala collection is also Lamarck's *curvirostris*. Its beak is bent slightly to the right and very slightly curved.

Strombus pes-pellicani

1758, *Systema naturae*, ed. 10, p. 742, no. 422.

1767, *Systema naturae*, ed. 12, p. 1207, no. 490.

LOCALITY: "In O. Europaeo, Norvegico, Mediterraneo, Americano" (1758, 1767).

"S. testae labro tetradactylo palmato digitis angulato, fauce laevi."

The description is identical in the tenth and twelfth editions of the "Systema."

The word "tetradactylo" indicates that Linnaeus had included both the produced anterior and posterior canals as digitations or "fingers" in addition to the true digitations on the lip of the shell, whereas this method of counting has not been followed by some later writers. The typical form of the species has a short anterior canal which is shaped like a spearhead. It has also a more produced posterior canal which is erect but slightly divergent from the spire, never rising so high as the apex of the shell and not adherent to it. The outer lip proper is much expanded and bears two fingers, of which the upper is always the longer and more pointed, the lower being usually so much shorter and blunter that it can be said to have the shape of a spearhead. Some of the early descriptions reflect this difference in the count of the figures, as we find the species sometimes described as having four or three, which indicates that the describer was including one of the produced canals, probably the longer posterior canal.

There is, moreover, considerable variation in the number, shape, and development of the digitations. Some individuals have more than two on the lip proper, and in such cases two or more of the lower members are usually

partially or completely coalesced. At times the lower of the two is so undeveloped that it is merely a thickened lobe on the lip. Variations also occur in the canals. The anterior canal is at times more produced and more sharply pointed than in the typical form, and specimens are seen in which the posterior canal is reflected to the right, thus making it easier for the describer to count it as a digitation of the lip. Descriptions of this species must be read with care in order to determine not only whether or not the describer was including one or both canals but whether or not he was describing a specimen rather than the species. A long series of specimens, even from the same region, may exhibit many variations in the features noted above. The only constant features are, first, that the extension of the posterior canal diverges from the spire and is not adherent to it, and, second, that the upper digitation on the lip is the longer and more sharply pointed. Johnson (1930, p. 3), in comparing *pes-pellicani* with its western Atlantic congener *occidentalis*, mentioned a variation, which he designated as a gerontic form, saying: "A study of a large series of *Aporrhais pes-pellicani* Linné shows in senile specimens a thickening of the lip until the posterior canal becomes obsolete. This feature is best shown in the specimens from Clyde, Scotland, labeled 'var. *bilobata*.' " I have not seen specimens in this senile stage.

Linnaeus' synonymy, while it reflects these numerous variations, and while it contains figures of very faulty draftsmanship, is partly correct and should be studied.

The figure from Rondelet (1554-1555, p. 92, the left-hand, unnumbered figure) is typical *pes-pellicani*, with two digitations on the lip.

The Buonanni figures (pls. 85, 86, 87) all show sinistral shells. Figure 85 shows a shell that seems to be based on the species called *Rostellaria serresiana* by Michaud, 1828 (see p. 245). Figure 86, although badly drawn, was probably based on a juvenile specimen of *pes-pellicani*. Figure 87 is probably meant for *pes-pellicani*.

The figure from Lister ("t. 866. f. min.") was an error for plate 865 and was corrected in the notes for Linnaeus' proposed "revised twelfth edition." The single figure on the latter plate shows two digitations on the lip

and an anterior canal, the posterior canal being not produced. It was possibly based on a senile specimen as described by Johnson and referred to above.

The Gualtieri drawings (pl. 53, figs. A, B, C) are apparently the artist's approximations to the specimens before him. Figure A undoubtedly shows an undeveloped juvenile shell. Figure B has three projections on the lip and a short anterior canal. Figure C is the typical form but with an anterior canal slightly longer than is normal.

Argenville's figure (1742, pl. 17, fig. M) shows a five-fingered form, the lowest of the three digitations on the lip being merely a rounded node.

Seba's figure (pl. 62, fig. 17) was probably meant for *serresiana*, which is described below. It has two very long fingers on the lip and a much produced anterior canal, in addition to the posterior canal.

Ginanni's work was not available to the present writer.

In Linnaeus' manuscript notes in his copy of the twelfth edition a figure from Petiver (pl. 79, fig. 6) was added to the synonymy. This shows only a single, short, spearheaded projection on the lip and a rudimentary posterior canal adherent to the spire. It may represent a monstrosity, or be merely a very casual drawing, as were many of Petiver's figures.

The species remained in *Strombus* Linné until 1778, when Da Costa (1778, p. 136) erected the genus *Aporrhais*¹ for its reception, a generic placement that is used today by many conchologists. Da Costa, however, altered the specific name to *quadridus*. Otto Müller (1788–1806, vol. 3, p. 10, pl. 87, figs. 1, 2) used the species in his *Tritonium*. However, many writers of the first half of the nineteenth century followed Lamarck in including the species in *Rostellaria*.

In 1836 Philippi (1836, 1844, vol. 1, p. 215) erected the genus *Chenopus* for *pes-pellicani*, but this name has been only infrequently used in recent years to replace *Aporrhais*. Deshayes and Milne-Edwards (1835–1845, vol. 9, p. 652) reported that both they and Philippi

had examined the animal of *pes-pellicani* and, from the anatomical details observed, demonstrated that it should be separated from *Rostellaria* Lamarck and that the erection of the genus *Chenopus* was therefore necessary. These authors did not mention the genus *Aporrhais* except to cite it in their synonymies of the several species they attributed to *Chenopus*. While the anatomy of the species certainly justifies its removal from *Rostellaria*, I see no reason for the adoption of *Chenopus* to replace *Aporrhais*, which has over half a century of priority of publication, as I can find nothing in the original descriptions of the two genera to justify the change. *Strombus pes-pellicani* is the type species of both genera, by monotypy.

Jeffreys (1867, pp. 249–255) has supplied the most ample and useful account of the British form of this species, although it is obvious that he did not describe the typical form. That part of his description covering the outer lip and canals is here quoted: "outer lip large, white, microscopically granulated inside; it is expanded into a broad flap in front, a triangular and incurved process at the base and another triangular process at the upper end of the mouth. *The flap has three angular processes*, the upper being longer than either of the others, which approximate: each of these different processes (*five in number*) is grooved in the middle, but the smallest process (which is situated next to the base and is sometimes rudimentary) less distinctly; the process above the outer lip diverges from the spire, and seldom extends higher than within six whorls of the apex. . . . Monstrosities are not uncommon, especially in the shape and relative size of the digitated processes; the basal point, however, is always formed like a spear-head" (*italics mine*).

It is clear from the above that he was not describing the typical four-fingered shell, and the quoted language does not conform to Donovan's figures of the British *pes-pellicani* (1799–1803, vol. 1, pl. 4), nor to the excellent description and figure in Da Costa (1778, p. 136, pl. 7, fig. 7).

Jeffreys discusses three other forms which he treats as good species. As to the specific separability of two of them it is difficult to be convinced.

The first is *Aporrhais serresianus* (Mi-

¹ The *Aporrhais* of Aldrovandi and of Gualtieri appears to be the same as *Lambis* Röding, 1798 (*Pterocera* Lamarck, 1799). Klein's *Aporrhais* was apparently based on a *Voluta* species.

chaud), 1828 (p. 120, only plate, figs. 3, 4). The figures are excellent and conform entirely to the details of the description. Jeffreys described it as a Mediterranean shell which differs from *pes-pellicani* "in its small size, delicate texture, fewer and rounded (instead of angulated) whorls and in the spire being much less tapering." Jeffreys omitted the most important diagnostic feature of the form, which appears in the following excerpt from Michaud's original description: "This shell, close to *R. pes-pellicani*, is distinguished by its constantly smaller size, but its much thicker shell, but especially by its four digitations, of which the one nearest to the spire is almost parallel and exceeds it in length, while in the Lamarckian species [*sic*] this digitation diverges obliquely from the spire and is always shorter" (italics mine). Michaud located it at Barcelona, living with *pes-pellicani*. He might have added that the uppermost digitation on the lip is much longer than the corresponding member in *pes-pellicani* and that the anterior canal is longer and sharper than in that shell.

Deshayes and Milne-Edwards (*tom. cit.*, p. 658) did not recognize *serresiana* as a good species but placed it in the synonymy of *Aporrhais pes-carbonis* Brongniart, 1823, a name discussed below. Tryon, however (1879-1888, vol. 7, pp. 131-132), treats it as a good species. Philippi (1836, 1844, vol. 1, p. 185) considered it as a mere variety of *pes-pellicani*. In view of the great differences from the Linnaean shell in size, structure, and texture, in the fact that it has three digitations on the lip proper, in the greater height of the process formed by the posterior canal, and in the greater extension of all the processes, I would be unwilling to synonymize it with *pes-pellicani*.

The second name mentioned by Jeffreys was *pes-carbonis* Brongniart, 1823, described as a fossil from the Miocene of Bordeaux and Antwerp. Tryon (*loc. cit.*), in his discussion of *Aporrhais serresianus*, said that the latter shell is "also known as *pes-carbonis* Brong., which is, however, wrong, the latter being a fossil and a different species. Dr. Gwyn Jeffreys gave it the name of *A. macandreae*." The present writer has seen only a few specimens labeled *pes-carbonis*.

One lot of three specimens have what appear to be five fingers on the outer lip, but the lower group is so completely coalesced that it is difficult to be certain of the number of fingers it represents. These specimens do not seem to be fossil. Another lot from Cannes, France, are obviously Recent shells. They show one erect process at the posterior end of the aperture (the extension of the canal), three clear digitations on the lip, the lowest being shortest, and an anterior canal longer than in any individual of *pes-pellicani* I have seen. The name *pes-carbonis* may be, as Deshayes and Milne-Edwards said, merely another name for *serresianus*. It may be a good species. But it would take a larger series than was available to the present writer for any conclusion to be reached. It is probably found fossil, as Michaud said, but if the Cannes specimens seen represent the same shell, it is certainly living today. The specimens examined are within the range of variation of *A. serresianus*.

Aporrhais senegalensis Gray (1838, p. 27) was the third species mentioned by Jeffreys. Tryon (*loc. cit.*) felt that it was either identical with *pes-pellicani* or closely allied to it. Gray described it as: "Shell regular, spirally striated; the upper whorls with one central and the last with two subcentral, series of small nodules, with a series of much smaller tubercles in front of them; outer lip with two acute expanded lobes." I cannot predicate much on this description. The details of the sculpture of the spire seem to take it out of the range of *pes-pellicani*, but the mention of two acute digitations on the lip suggests that species.

Cirropteron semi-lunare Sars, 1835, is, *fide* Mörch, merely the larval stage of *pes-pellicani*.

We are faced, in *pes-pellicani*, with a species that is extremely variable. Many of the features that are seen in the other so-called species mentioned are occasionally seen in *pes-pellicani* and its various forms. Finally the descriptions and figures supplied for each of these names, either by their authors or by subsequent describers, are markedly discordant. It seems that we have here a complex with a great potentiality for variation, which renders the fixing of specific names almost impossible in the absence of larger series than

are found in our museums and, more important, in the absence of any genetic data. As said above, I believe *serresianus* to be a good species. As to *pes-carbonis* it may be inseparable from *serresianus*. In any event it is not *pes-pellicani*. *Aporrhais senegalensis* is, in my opinion, so scantily described that it should be considered a *species dubia*. It was not figured.

A specimen of the British *Aporrhais pes-pellicani*, of the typical form, is found in the Linnaean collection in London in a tray marked for this name, which confirms the identification.

The species is described in the "Museum Ulricae." It is apparent that the specimen on which this description was based was not the typical form, as the process formed by the extension of the posterior canal is described as adhering to the spire ("quarum prima adhaerens spirae brevior"). This feature is occasionally found in specimens of the shell which are usually designated as monstrous. This odd form was also the one described by Dillwyn (1817, p. 637) who said: "The outer lip is divided into four strong projecting segments, of which the upper one is attached to the spire." Dillwyn's description of four strong projecting segments is also unlike the typical *pes-pellicani*, in which the two lower digitations cannot usually be described as "strong." A specimen of the *pes-pellicani* of all authors is in the Uppsala collection, properly labeled. The photograph of this species in the microfilm of the collection shows the digitation formed by the extension of the posterior canal to be partly adherent to the spire.

The species is figured in Reeve (1843-1878, vol. 6, *Rostellaria*, pl. 1, sp. 3a, 3b, dorsal and ventral aspects); in Donovan (1799-1803, vol. 1, pl. 4); in Sowerby (1847-1887, vol. 1, pl. 5, figs. 3, 4); and in Crouch (1827, pl. 18, fig. 3). Reeve also figures *pes-carbonis* on the same plate (sp. 1a, 1b) and makes it synonymous with *Rostellaria serresiana*.

Strombus chiragra

1758, *Systema naturae*, ed. 10, p. 742, no. 423.

1767, *Systema naturae*, ed. 12, p. 1207, no. 491.

LOCALITY: "Ad Bandam Asiae" (1756, 1767).

"S. testae labro hexadactylo, digitis curvis, cauda recurvata." . . . Digiti antrorsum incurvati, subtus sutura coaliti. Labium subtus antici distinctum rima: inter digitos posteriores ad caudam hians. Faux sanguinolenta, in labio interiore substriata."

The main descriptions in the tenth and twelfth editions are identical except for a curious error in the tenth, where "pentadactylo" is used to describe the digitations or "claws" of the shell, instead of "hexadactylo." As the digitations in this species are all highly developed, are all of approximately equal length, and are the most obvious diagnostic features of the shell, the error must have been due to a *lapsus calami*, unless we accept the improbable explanation that Linnaeus had before him in the tenth edition an individual, one claw of which had been broken off and the shell so worn that the break was not evident. There is nothing in the manuscript notes of Linnaeus to explain the error. It was corrected in the twelfth edition, and the specimen marked for *chiragra* in the Linnaean collection in London is a typical and perfect specimen of the *chiragra* of all authors. The literature contains no mention of a five-clawed monstrosity. Linnaeus had discovered his error, however, long before the publication of the twelfth edition, as, in the "Museum Ulricae," which was published in 1764, while he repeated the tenth-edition description, as was his almost invariable custom, the expanded subdescription contained the phrase "Labium exiens in spinas sex."

The description in the "Systema," particularly the detailed and accurate subdescription, leaves no possible doubt as to the species Linnaeus was describing. The synonymy, however, is discordant and unsatisfactory, as most of the figures show immature shells, many show dorsal views only, and more than one species is figured.

The figure from Buonanni (pl. 312) was based on either *Strombus scorpius* Linné or *Pterocera pseudoscorpio* Lamarck, 1822, although it was not cited by Linnaeus for the former. The figure was undoubtedly an error of transcription for either plate 314 or 315, both of which show *chiragra*. The cited plate 312 was later cited by Lamarck for his *pseudoscorpio* (1822, vol. 7, p. 197), and both 314

and 315 were cited by Lamarck for *chiragra* (*tom. cit.*, p. 198).

Two Rumphius figures were cited (pl. 35, figs. A, B). Figure A shows either *chiragra* or its congener *rugosa* Sowerby, 1842. Hanley (1855, p. 266) criticized the synonymy because it included both species and remarked that "until lately" the two had been confounded. The name *rugosa* probably represents a good subspecies of *chiragra*, and should be known by its earlier name, *arthritica* Röding, 1798. Therefore the appearance of a figure of *arthritica* does not of itself render the synonymy discordant.¹ Figure B shows the immature shell before the lip becomes expanded.

The Seba references (pl. 83, figs. 1, 2) are confusing. The *chiragra* of Linnaeus is shown in the second and third figures in both the second and third rows of plate 82. Hanley (*loc. cit.*) said of them: "... but, as no numerals were attached to the drawing, Linnaeus has altogether avoided citing that plate." This seems a fanciful explanation. The cited figures 1 and 2 on plate 83 all show species of other genera, and I have no explanation of the error.

Of the figures from Gualtieri (pl. 35, figs. A, B, and pl. 36, fig. B) the last resembles *Strombus lambis* Linné. Figure A on plate 35 shows an immature shell of *chiragra*. Figure B on that plate seems to be clearly *arthritica* Röding.

The Barrelier figure was not available to the writer. Hanley (*loc. cit.*) said that it was erroneous, as there is no such lettered figure and that either figure 8 or 9 was intended.

¹ Tryon (1879-1888, vol. 7, p. 126), after listing *chiragra* (which he put in the section *Harpago* Klein, 1753), cited *rugosa* Sowerby, saying: "probably only a variety of the preceding species. . . It is *P. chiragra* Lam., in part, and *P. arthritica* Mörch." The most recent comment on the position of *rugosa* is that of Abbott (1950, p. 74), who said: "There still seems to be some doubt as to the nature of *Lambis arthritica* Röding (= *rugosa* Sowerby). It is quite possible that *arthritica* Röding is a subspecies of *chiragra* with an Indian Ocean distribution. In a few localities, such as the Marshall Islands, the shells show a combination of the respective characters of these two species. *L. arthritica* is smaller, not as elongate, with heavy whitish creamy plications in the aperture between which are dark purplish streaks. In *L. chiragra* Linné, these plications are much weaker and usually further back in the rosy cream aperture."

The figure from Belon (p. 422) called "*Purpura pentadactylus*," is useful merely because it shows *chiragra* rather than *arthritica*. It is a wretched drawing in other respects.

The species is now included in the genus *Lambis* Röding, 1798, which has one year's priority over *Pterocera* Lamarck, 1799. Prior to 1906, when the Röding names in the "Museum Boltenianum" came to the renewed attention of conchologists, *Pterocera* was universally used for *chiragra* and the other closely allied species of spider shells. *Harpago* (Klein) Mörch, 1852, which was revived by Mörch for this species, is a synonym, in part.

The description of *chiragra* in the "Museum Ulricae," already referred to, may be taken to describe *chiragra*, although the sculptural differences between it and the form (or subspecies) *arthritica* Röding are not mentioned. Likewise, the position and color of the plications in the aperture, in which the two forms differ, are not stated. The two specimens now labeled *chiragra* in the collection in Uppsala are definitely *arthritica*, and may have been the shells on which the description was based, although, as so often said in these papers, the labels in that collection must always be treated with suspicion.

The present species is figured in Martini (1769-1777, vol. 3, pl. 86, figs. 853-854) and in Reeve (1843-1878, vol. 6, *Pterocera*, pl. 2, sp. 2). *Lambis arthritica* Röding was probably the model for a pair of Martini figures (*tom. cit.*, pl. 87, figs. 856-857), which Martini (p. 154) called "*Ungula Diaboli*." The best black and white figures of the two shells are supplied by Abbott (1949, 2 pls., pp. 324-325). A good colored photograph of *arthritica* is found in Platt (1949, p. 68, fig. 1), labeled *rugosa*. Thiele's figure labeled *chiragra* (1931, p. 255, fig. 266) seems clearly *arthritica*.

The species was called *Alata chiragra* by Meuschen in the "Museum Geversianum," 1787, and was the *Strombus cancer* of Humphrey in the "Museum Calonnianum," 1797. Röding's *Lambis chiragra* is not the *chiragra* of Linnaeus, but *Strombus scorpius* Linné, according to Adam and Leloup (1938a, p. 120).²

² Adam and Leloup were quite correct in their estimation of Röding's conception of these names. Röding

Strombus scorpius

1758, *Systema naturae*, ed. 10, p. 743, no. 424.

1767, *Systema naturae*, ed. 12, p. 1208, no. 492.

LOCALITY: "In O. Asiatico" (1758, 1767).

"S. testae labro heptadactylo, digitis nodosis: postico longissimo . . . Faux violacea, striata."

The words "Faux violacea, striata" in the subdescription were added in the twelfth edition. The description is entirely adequate to identify the Linnaean species with the *scorpius* of all authors. In particular, the phrase "digitis nodosis" serves to distinguish it from *Pterocera pseudoscorpio* Lamarck, 1822, the only species that could be confused with it, as in the latter the claws are smooth and not studded with tubercles. The latter species is also more highly colored.

The synonymy may show both species. The figure from Rumphius (pl. 36, fig. K) is unmistakably *scorpius*, as is that from Argenville (1742, pl. 17, fig. B), both figures showing clearly the nodosity and irregularity of the claws. Gualtieri's figure (pl. 36, fig. C) is uncertain. Although its claws lack the nodes, it was apparently based on an immature specimen and therefore equivocal. On this point it may be significant that Linnaeus, by a

cited for *Lambis chiragra* (1798, p. 67) not only Gmelin's *Strombus scorpius*, but a figure from Martini (1769–1777, vol. 3, pl. 88, fig. 860) which is one of the best pictures of *scorpius* that has ever been published. While Martini called it "Alata arthritica," he referred it to the *scorpius* of the "Systema." Röding listed *Lambis scorpius* separately, referring it to a pair of Chemnitz figures (1780–1795, vol. 10, pl. 158, figs. 1508–1509). These figures represent neither *scorpius* nor *pseudoscorpio*, but are unmistakably a quite distinct species, *Pterocera crocatus* Link, 1807 (*Lambis crocata*), the *Pterocera aurantia* of Lamarck. Chemnitz called this species "S. scorpio," but did not refer it to the *scorpius* of the "Systema." He did refer it to Schröter's "Scorpion" (1783–1786), vol. 1, p. 469, pl. 2, fig. 15) which shows *pseudoscorpio* Lamarck.

Röding also listed *Lambis arthritica*, for which he cited a further Martini figure (*tom. cit.*, pl. 87, fig. 857, apertural view), which resembles *arthritica* somewhat more than *chiragra* Linné, although the ridges in the aperture are incorrectly colored. Martini called it "Ungula diabolus" and gave no references. He described the aperture as "oro violaceo, albo striato," which is a correct description of the ridged mouth of *arthritica* but does not conform to the reproduction of this feature in the figures cited, where the ridges of the aperture are black, with a brilliant blue between them. He mentioned that he owed the picture of this shell to the "Illustrious Dri. Bolten," a reference that is not understood, as no figures were supplied in the Bolten Catalogue.

manuscript note in his copy of the twelfth edition of the "Systema," wrote the word "bona" after the Rumphius and Argenville figures but did not comment on the figure from Gualtieri. It is nevertheless apparent that Linnaeus considered the two shells to be forms of a single species; as both are present in the Linnaean collection in London and both are marked for *scorpius*. Reeve was, I believe, the only writer after Lamarck who united the two shells. He said (1843–1878, vol. 6, *Pterocera*, pl. 3, sp. 3) that *pseudoscorpio* was a "local variety" of *scorpio*. Hanley (1855, p. 267) recognized that Linnaeus' synonymy involved a composite species and that Linnaeus was probably deceived in uniting them. He said: "As the name can only be used for one of them . . . it is desirable to follow tradition."

Swainson (1841, p. 32), in the appendix to his "Exotic conchology," used the name *Pterocera nodosa* for the Linnaean species. It is a question whether he derived the name from Rumphius, who called the species "Cornuta nodosa," or from the designation of the species in the "Liste" where it is referred to as "*Pterocera nodosa*." Other than Swainson's name I know of no other synonym for the species.

As are *chiragra* and the other spider shells discussed below, *scorpius* Linné is now contained in the genus *Lambis* Röding, 1798, as *Lambis scorpio*.

It was well figured by Martini (1769–1777, vol. 3, p. 157, pl. 88, fig. 860) who called it "Alata arthritica,"¹ but referred it to *Strombus scorpius* Linné. Reeve also figured it (1843–1878, vol. 6, *Pterocera*, pl. 3, sp. 3), describing it as "Well distinguished by the sharply noduled claws and intense violet coloring internally." *Lambis pseudoscorpio* Lamarck is figured in color by Schubert and Wagner in the twelfth volume of the "Conchylien-Cabinet" (1829, p. 16, pl. 218, figs. 3040–3041). A pair of Chemnitz figures (1780–1795, vol. 10, p. 224, pl. 158, figs. 1508–1509) shows a shell that closely re-

¹ Röding probably borrowed his specific name *arthritica* from this Martini description, although he applied it to another species (see discussion of *S. chiragra*, the preceding species, footnote, p. 248), as I cannot find that anyone earlier than Martini had used the name.

sembles both *scorpio* and *pseudoscorpio* in gross characters but which were certainly based on another species, *Pterocera crocatus* (*Lambis crocata*) Link, 1807, and have been several times misapplied. Gmelin (1791, p. 3509) cited them for this variety "γ" of *Strombus lambis* Linné, with no description of the variety. Dillwyn (1817, p. 658) referred to them for his variety "B" of *Strombus lambis*, described as "with the claws longer and more slender, and throat orange." Lamarck (1822, vol. 7, p. 198) was the first to cite them correctly, as he placed them in the synonymy of his *Pterocera aurantia* which was a mere new name for Link's *crocatus*. Chemnitz called his pair of figures "*Strombus scorpio*."

The species *scorpius* was described in the "Museum Ulricae" and, with one exception, the added details in the expanded description in that work assist and confirm the identification with the *Lambis scorpio* of authors. The description of the aperture and throat does not fit the typical *scorpio*. It reads: "Apertura flava s. incarnata. Faux nigricans striis transversis, albis." The word "flava" suggests *pseudoscorpio* rather than *scorpio*, and the description of the throat, where the deep violet color is found, must have been based on a peculiarly dark inner aperture. The specimens today labeled for the species in the collection at Uppsala are *scorpius*, but in the photograph the color within the aperture cannot be determined.

Strombus lambis

1758, *Systema naturae*, ed. 10, p. 743, no. 425.

1767, *Systema naturae*, ed. 12, p. 1208, no. 493.

LOCALITY: "In O. Asiae" (1758, 1767).

"S. testae labro heptadactylo: digitis rectiusculis, fauce laevi . . . Testa testacea albo maculata. Faux subincarnata.

The description of *lambis*, only the sub-description having been added in the twelfth edition, is adequate to identify the species with the *lambis* of authors. Only one word, "rectiusculis," might be criticized, as only the digitation formed by the extension of the posterior canal can be said to be even reasonably straight. Possibly Linnaeus used the word to contrast the digitations in *lambis* with those of the two preceding species *chiragra* and *scorpius*, in which the digitations are much more markedly curved.

However, the three anterior "fingers" of *lambis* are curved almost if not quite as much as those of the following species *millepeda* where they are described as "inflexis."

Most of the numerous figures cited in the synonymy correctly show *lambis*. The Argenville figure (1742, pl. 17, fig. E) is a fair picture of *lambis*. The Buonanni figure (pl. 315) was probably meant for *chiragra*. The remainder of the references (Rondelet, 1554-1555, pt. 2, p. 79; Rumphius, pl. 35, figs. E, F; Gualtieri, pl. 35, fig. C, and pl. 36, fig. A; and Regenfuss, pl. 4, fig. 45) may probably all be said to show *lambis*, although they are poor figures, with the exception of that from Regenfuss which, as usual, is the best of the pre-Linnaean drawings.

The species is probably the "*Strombus camelus*" of Chemnitz (1780-1795, vol. 10, p. 205, pl. 155, fig. 1478), although the figure is much distorted, showing the anterior digitations of the lips bent backward over the dorsum of the shell. It was cited for *lambis* by Lamarck (1822, vol. 7, p. 196). It is also the *Murex Aporrhais* of Rondelet, whose figure was cited by Linnaeus. It has been identified by some writers with *Pterocera crocatus* Link, 1807, possibly because Link cited for the latter species Gmelin's variety "γ" of *Strombus lambis*. Gmelin, however, cited for his variety a pair of Chemnitz figures (*tom. cit.*, pl. 158, figs. 1508-1509) which resemble *Pterocera pseudoscorpio* Lamarck and could not be referred to any form of *lambis*. A good black and white figure of *Lambis crocata* Link is supplied by Abbott (1949, p. 324). Chemnitz' shell was called by him "*Strombus scorpio*" without any reference to the "Systema," but was unmistakably based on a specimen of *crocatus* Link, and the golden yellow color of its aperture is shown in figures and noted by Link by the word "Safranfarbig."

Gmelin's five other varieties of *lambis* and Dillwyn's three are based apparently on slight differences in the shape, length, and disposition of the digitations and the color of the aperture and are not used today, as the slight variations in this very common shell are not considered to have any specific or subspecific validity.

It is placed today in the genus *Lambis* Röding, 1798, of which it is the type species, by absolute tautonymy. It is also the type species of *Pterocera* Lamarck, 1799, by monotypy.

A specimen of *lambis* is found properly marked in the Linnaean collection in London, thus confirming the identification.

The first post-Linnaean figures of the species (Martini, 1769–1777, vol. 3, p. 154, pl. 87, figs. 858–859) have scarcely been bettered from the point of view of accuracy and draftsmanship. It is also figured by Reeve (1843–1878, vol. 6, *Pterocera*, pl. 5, sp. 8). Abbott (1949, p. 324) supplies an excellent photographic figure.

The description in the "Museum Ulricae" is clearly *lambis*. Hanley (1855, p. 267) felt that in that work the account of the claws was more reminiscent of *bryonia* Gmelin than of *lambis*. The pertinent language reads: "... spinas septem, quarum prima vix spirae apicis latus attingens; postrema s. caudalis inflexa, nec versus dorsum flexa." Although this is, in part, a very misleading description of the digitations of *lambis*, I see nothing in it that necessarily points to *bryonia* rather than to *lambis*.¹

Since Chemnitz' *Strombus camelus*, 1788, I know of no synonyms for the species except a misuse of the name by Blainville. His *Pterocera scorpio* (1825, 1837, p. 414, pl. 25, figs. 3–4) is certainly *lambis* Linné.

Strombus millepeda

1758, *Systema naturae*, ed. 10, p. 743, no. 426.

1767, *Systema naturae*, ed. 12, p. 1208, no. 494.

LOCALITY: "In O. Asiae" (1758, 1767).

"S. testae labro decadactylo, digitis inflexis, fauce substriata, dorso gibbere compresso."

The above description, which is identical in the tenth and twelfth editions of the

"Systema," was based unmistakably on the *millepeda* of authors, as there is no other ten-fingered species in the genus *Lambis* Röding, 1798, in which the present species is contained, along with the other spider shells in *Strombus* Linné. Moreover, our *millepeda* conforms to all the other details of the description.

There has been a certain amount of confusion of *millepeda* with several other species. One of these was *Pterocera elongata* Swainson, 1821–[1822]. This was originally described by Chemnitz (1780–1795, vol. 10, p. 207, pl. 155, figs. 1479–1480) under the name of *Strombus novem dactylus*. Deshayes and Milne-Edwards (1835–1845, vol. 9, p. 678) adopted the species as their own under the Chemnitzian name, although they put *Pterocera elongata*, which they attributed to Kiener, in its synonymy. Lamarck (1822, vol. 7, pp. 196–197) had not mentioned it by name and had failed to distinguish it from *millepeda*, as the Chemnitz figures 1479 and 1480 were cited in the synonymy of the latter. Dillwyn (1817, pp. 659–660) had already separated this species, but only as a variety of *millepeda* Linné, designating it as "Variety B. With nine claws connected by an extension of the outer lip." *Pterocera elongata* is quite distinct in appearance from *millepeda*. In addition to the greater length of its aperture, it possesses only nine digitations, those on the lip proper being less erectly hooked and stemming from a scalloped extension of the lip, whereas in *millepeda* these digitations begin behind the outer edge of the lip which is divided into segments by notches or folds. In both species the digitations are rib terminations, the distinction being that in *millepeda* they separate from the body whorl before the edge of the lip is reached. Dillwyn's description of this feature in *elongata* is graphic.

Another species that has been confused with *millepeda* is *Strombus digitatus* G. Perry, 1811. This is distinguished principally by the fact that three or four small lobes or rudimentary fingers, seen in both *millepeda* and *elongata* at the base of the shell to the right of the anterior canal, are here much emphasized in length and become true digitations, or at least have been so considered, giving the shell 12 to 14 digitations. Also the outer lip is widely flaring posteriorly and rises above the spire, the first digitation next to the spire

¹ It is probable, and I believe now generally agreed, that *bryonia* is identical with *Strombus truncatus* Humphrey, 1786, of the Portland Catalogue. The figures Gmelin cited for his *bryonia* (Martini, *tom. cit.* in text above, p. 187, pl. 93, figs. 904–905; and Chemnitz, 1780–1795, vol. 10, p. 227, pl. 159, figs. 1512–1515) all show a shell in a growth stage before the lip has fully expanded and the claws have appeared. It was described, however, as "labro mucronato octodentato," the eighth claw being apparently the slightly developed tooth on the horizontal part of the base. Lamarck (1822, vol. 7, p. 195) said of *Pterocera truncata* for which he cited Gmelin's *bryonia* as a synonym: "The majority of authors figure this shell only in its immature state, when it lacks the digitations. I possess a mature specimen and in this condition it resembles a very large *lambis*." *Lambis truncata* is also equal to *Lambis davilaë* Röding, 1798. It is the largest of the *Lambis* species. The full-grown shell is figured by Abbott (1949, p. 325).

being broad at the base and definitely bifid in adult individuals. This is probably the species called *Strombus multipes* by Chemnitz (1780–1795, vol. 10, p. 216, pl. 147, figs. 1494–1495), although Chemnitz' figures are not entirely clear and do not adequately bring out the distinctions mentioned above. Dillwyn cited the above Chemnitz figures for his "Variety C. With twelve claws" of *S. millepeda*. Lamarck (1822, vol. 7, pp. 196–197) also failed to separate it, as he cited these two Chemnitz figures in his synonymy of *millepeda* Linné.

A third species that has been confused, at least with *Strombus digitatus* G. Perry, is *Pterocera violacea* Swainson, 1821–[1822], (unfigured). It is described in the appendix to Swainson's "Exotic conchology" (1841). Although the number of its claws is usually the same as in *digitatus*, it is a generally smaller shell, much paler in coloring, and is distinguished by its aperture which is white with the exception of a deep violet flush in its recesses. The digitation nearest the spire is not truly bifid, as in *digitatus*, but provided merely with a short rounded lobe on the left side of its base. It was made a synonym of *Pterocera multipes* (*Strombus digitatus* Perry) by Deshayes and Milne-Edwards (1835–1845, vol. 9, p. 677).

Deshayes and Milne-Edwards (*tom. cit.*, p. 673) in a footnote to their listing of *P. millepeda* finally resolved the confusion between *millepeda*, *elongata*, and *digitata*, although they continued to call the two last species by their earlier names of *novem dactylus* and *multipes*, respectively. As said in the preceding paragraph, they continued to synonymize *violacea* Swainson with *multipes*. The footnote reads: "Several species are frequently confounded by authors, under the name of *millepeda*; there are three which are more easily distinguished when one has them in hand, than when viewing their figures only. Linnaeus confused them all; it is therefore necessary to suppress the figures of Lister, de Favanne, Chemnitz, and the *Encyclopaedia*. Dillwyn forecast the separation of these species by using them as varieties of *Strombus millepeda*." They listed *Pterocera multipes* (*digitata*) and *novem dactylus* (*elongata*) as good species (pp. 677–678). Subsequent writers have accepted these names as representing species distinct from *millepeda*.

A further pair of figures of Martini (1769–1777, vol. 3, p. 160, pl. 88, figs. 861, 862) should be mentioned, although they are not sufficiently characteristically drawn to point surely to any one member of this complex. Martini called them "*Alata polydactylos*," and referred his species to *Strombus millepeda* Linné. The posterior portion of the lip resembles Swainson's *violacea* rather than *millepeda*, but the sculpture of the base is unlike that of either *violacea* or *digitata*. It is difficult to comment on these figures, and they should be examined. They were cited by Link, Dillwyn, Lamarck, and Deshayes and Milne-Edwards for *millepeda*, but I am strongly of the opinion that they were not based on that species. The figures in the "Tableau encyclopédique" (pl. 410, figs. 1a, 1b) are the only figures in that work applicable to this complex. They are called *Pterocera millepeda* in the "Liste," but they do not show that species. They show features of both *violacea* and *digitata*.

Linnaeus' synonymy is a collection of bad figures showing more than one species. Of the two Lister figures (pl. 868, fig. 23, and pl. 869, fig. 24), the figure on plate 868 shows a shell more resembling *elongata* Swainson than *millepeda*. The figure on plate 869, which, through a printer's error, is also numbered 23, appears to represent *millepeda*. The Buonanni drawing (pl. 311) seems to be *chiragra*; that from Rumphius (pl. 36, fig. I), the best figure in the synonymy, is *millepeda*; the Argenville figure (1742, pl. 18, fig. B) shows an immature *Lambis* species. The lower digitations are only partly developed, and those at the upper end of the lip consist merely of a series of flutings, so that it is impossible to count the number of eventual digitations. It is a dorsal view of the shell which makes it even less revealing.

The true *millepeda* is figured by Reeve (1843–1878, vol. 6, *Pterocera*, pl. 6, sp. 10); by Tryon (1879–1888, vol. 7, p. 125, pl. 9, fig. 9); by Sowerby (1847–1887, vol. 1, *Pterocera*, pl. 11, fig. 3); and by Abbott (1949, p. 324).

The Linnaean collection in London contains a properly marked specimen of *millepeda* which thus may be accepted as the type of the species.

The added details of the description in the "Museum Ulricae" clearly point to *millepeda*.

It adds the information that the claws are sometimes closed and sometimes open and patulous. I have seen very few adult specimens in which the digitations are "open." Most adult shells show either an almost closed fissure, or, in occasional individuals, a raised callous line indicating the location of the gap in the immature shell.

Strombus lentiginosus

1758, *Systema naturae*, ed. 10, p. 743, no. 427.

1767, *Systema naturae*, ed. 12, p. 1208, no. 495.

LOCALITY: "In O. Asiae" (1758, 1767).

"S. testae labro antice trilobo incrassato, dorso verrucoso coronato, cauda obtusa . . . Blatta Byzantina est hujus operculum; color ranae."

The description is the same in the tenth and twelfth editions of the "Systema," except for the addition of the short subdescription in the twelfth. It is entirely characteristic of the *lentiginosus* of all authors. The figures in the synonymy are fairly accurate with the exception of the two drawings from Borellier, according to Hanley. The Borellier work was not available to the present writer, but Hanley (1855, p. 268) said that the first (pl. 1326, fig. 4) showed *Strombus fasciatus* Born, 1780, and the second (1327, fig. 5) was a figure of *S. bituberculatus* Lamarck, 1822 (*S. raninus* Gmelin, 1791). He added that the figure Linnaeus should have cited is plate 1327, figure 6, a fair picture of *lentiginosus*. The remainder of the figures (Rondelet, 1554-1555, pt. 2, p. 91; Buonanni, pl. 300; Rumphius, pl. 37, fig. Q, from whose "Lentiginosa" Linnaeus borrowed his specific name; Gualtieri, pl. 32, fig. A; Argenville, 1742, pl. 18, fig. C; and Seba, pl. 62, fig. 11) are often cited for the species and are generally accepted as satisfactory, although the Argenville figure is the only entirely characteristic one. Another good figure (Lister, pl. 861) was added in manuscript by Linnaeus in his copy of the twelfth edition.

The species has never, to my knowledge, been given another specific name. However, owing possibly to a remark by Chemnitz, it was confused with *Strombus papilio* Dillwyn, 1817. Chemnitz, in 1788 (1780-1795, vol. 10, p. 227, pl. 158, figs. 1510-1511) originally described *papilio*, referring to two Seba figures (pl. 52, figs. 17-18) and two from Knorr (pl. 26, figs. 2-3) and

said: "This species of Flügelschnecken seems to me to be a close relative of *Strombus lentiginosus* Linné." As Chemnitz then listed the differences between the two species, his remark cannot be taken as a statement that they were conspecific, but Gmelin (1791, p. 3010) made *papilio* his variety " β " of *lentiginosus* and cited for it the Chemnitz reference and all the figures cited for it by the latter. Even as late as Dillwyn (1817, p. 661) who first validly proposed the name *papilio* some doubt remained. Dillwyn said, "This is rather an uncertain species, with which I am unacquainted, and Chemnitz says it is nearly allied to *S. lentiginosus*."

*Strombus papilio*¹ as a well-known species

¹ In connection with the name *papilio*, Swainson (1821-1823, vol. 3, pl. 134 and applicable text) published the new name *Strombus exustus*. He pointed out that the name *papilio* Dillwyn represented merely the juvenile shell of his *exustus*. The new name had also been used for the species by Humphrey in the "Museum Calonnianum," 1797, a work unavailable for nomenclatorial purposes under the terms of Opinion 51 of the Commission on Zoological Nomenclature. Iredale (1937, p. 412) referred both to Humphrey's and Swainson's use of the name *exustus*, saying: "Then, in the text to pl. 134 [of Swainson's 'Zoological illustrations'] *Strombus exustus* is quoted: 'Adult. *Strombus exustus*. Humphrey in Mus. Cal. p. 38, no. 714.' Specimens now before me prove that the *S. papilio* of Chemnitz is the young shell of *S. exustus*, a species named by Mr. Humphrey in the Calonne Catalogue, and described in his own manuscripts." In specimens labeled *papilio* the aperture is smooth and nearly pure white, whereas in the form *exustus* it is dark, ranging from reddish purple to dark brown. Both Reeve (1843-1878, vol. 6, *Strombus*, pl. 13, sp. 29), who called the Swainson species "*adustus*," and Deshayes and Milne-Edwards (1834-1845, vol. 9, p. 707) treated the two names as synonymous, but neither referred to their respective use for the immature and adult shell. The same is true of the treatments by Sowerby (1847-1887, vol. 1, p. 37) and Tryon (1879-1888, vol. 7, p. 110). Both listed *exustus* as a synonym of *papilio*, but it is odd that the figures of each were of the dark form *exustus*. With the exception of Swainson and Iredale I have found no writer who attributed the two names to different life stages of the shell. I am much inclined to discount the theory that *papilio* is the young *exustus*. It may have been that in the specimens examined by Swainson and Iredale the dark forms were the largest and thus appeared the more mature, but I have not been able to perceive any difference in this respect between the two forms. In any case, even if the two color forms can be proved to apply to the two life stages, the name *papilio* Dillwyn must be used for both under the terms of Article 27(b) of the Rules of Zoological Nomenclature, to the effect that the Rule of Priority obtains when any stage in the life history is named before the animal itself.

to later writers and is quite distinct from *lentiginosus*, although somewhat similar in its gross features. It lacks the thickened triple crenulation at the posterior end of the lip of *lentiginosus*, which is replaced by a deep semicircular sinus which itself often bears one or more crenulations. It is generally smaller and lacks the thickened lip of the Linnaean species, its lip margin being reflected inward and usually sharp. The aperture is dark brown instead of colorless, although *lentiginosus* occasionally carries a very light purplish wash in the recesses of the aperture, and the whole aperture is sometimes a faint tan. The aperture of *papilio* is rugose. That of *lentiginosus* is smooth.

With the exception of Link (1807, p. 109) who placed it in his broad genus *Lambis*, a group containing many true *Strombus* species in addition to the several spider shells, *lentiginosus* has always been retained in *Strombus* Linné.

It was first figured by Martini (1769–1777, vol. 3, p. 120, pl. 80, figs. 825–826). Reeve's figure (1843–1878, vol. 6, *Strombus*, pl. 13, sp. 31) is characteristic.

The identification with the *lentiginosus* of all authors is confirmed by the presence of a properly documented specimen in the Linnaean collection in London.

The description of *S. lentiginosus* in the "Museum Ulricae" adds, as usual, many confirmatory details and refers to the three best figures cited in the "Systema" (Argenville, Rumphius, and Gualtieri). The expanded description, however, is puzzling in two respects. Linnaeus there distinguished *lentiginosus* from *S. chiragra* and *S. lambis* in the words "Testa S. Chiragrae et Lambis, distincta solo labio spinis destituo." The distinction between *lentiginosus* and the two species mentioned is so obvious that the quoted words are quite unnecessary. Secondly, in the description of the outer lip, the language suggests something other than *lentiginosus*: "Labium absque sinu, tenue aut marginatum, dehiscens . . ." The species has the typical stromboid notch or sinus near the base of the lip, developed fully as strongly as in most of the other *Strombus* species possessing this feature, and the lip is hardly so markedly expanded as to justify the use of the word "dehiscens," a word that Linnaeus used for no other *Strombus* species in either

the "Systema" or the "Museum Ulricae." The quoted passages cast at least a scintilla of doubt on the identity of the specimen Linnaeus had before him in the Queen's collection. In fact, the word "tenue," used in the description of the lip, is quite inappropriate to the thickened and involute lip of adult specimens of *lentiginosus* and suggests that Linnaeus was describing either an immature shell or an unusually sharp-lipped specimen of *papilio*. The specimen labeled *lentiginosus* in the Uppsala collection today is an adult specimen of *lentiginosus*. The film reproduction gives a dorsal view, so that the nature of the lip cannot be determined.

Lambis rana Röding, 1798, is a synonym.¹

Strombus gallus

1758, *Systema naturae*, ed. 10, p. 743, no. 428.

1767, *Systema naturae*, ed. 12, p. 1209, no. 496.

LOCALITY: Not given in either edition.

"S. testae labro dilatato; antice mucronato longissimo, dorso coronato, cauda recta."

The word "longissimo" as applied to the posterior projection of the lip is the decisive factor in the identification of the Linnaean species with the *gallus* of authors, as several other species of *Strombus* conform to the other characters noted. It is such a distinctive shell in appearance that it was known to both pre-Linnaean and post-Linnaean writers from earliest times.

The synonymy is, with one exception, correct. The figures from Buonanni (pls. 308, 309), Gualtieri (pl. 32, fig. M), and Seba (pl. 62, figs. 1, 2), the Seba reference being added in the twelfth edition, are unquestionably based on *gallus*. The Rumphius figure (pl. 37, fig. 5) is a much distorted drawing and may have been intended to represent *gallus*, but is not sufficiently characteristic to be cited for it.

In spite of the good description and the correctness of the majority of the figures cited, some of the post-Linnaean writers con-

¹ The figures cited by Röding for *rana* (Martini, 1769–1777, vol. 3, p. 118, pl. 81, figs. 827–828) were called "Alata lentiginosa" by Martini and were referred to the *lentiginosus* of the "Systema." The figure cited for *lentiginosa* (*tom. cit.*, p. 180, pl. 91, fig. 892) was called "Alate lentiginosa in juventate s. imperfecta," and was not referred to the Linnaean species. None of these figures is particularly good, but all are recognizable for *lentiginosus* Linné. Figure 892 appears to be based on a slightly younger shell.

fused this species with other coronate species of *Strombus* having any suggestion of a wing or projection of the posterior end of the lip. This was undoubtedly partly owing to the fact that, in *gallus*, there is a great variation in the length of the wing even in adult shells, and, in the juvenile state, the species might be confused with shells such as *S. tricornis* Humphrey, 1786, of the Portland Catalogue, *S. raninus* Gmelin, 1791, and *S. pacificus* Swainson, 1841, and *peruvianus* Swainson, 1823.

Martini, in addition to his fairly characteristic figures of *gallus* (1769–1777, vol. 3, pp. 137–139, pl. 84, figs. 841–842), described and figured several other shells under various names, which were either badly drawn or immature *gallus* or related species that cannot be identified. (See *tom. cit.*, p. 130, pl. 83, figs. 836–837, which probably represent *Lambis curruca* Link, 1807; p. 140, pl. 84, figs. 843–845, which is called "Pugil tricornis" and is the *Strombus tricornis* of Humphrey; p. 141, pl. 85, fig. 847, which may have been based on an immature *gallus*, and was cited by Gmelin for his variety "ε" of *S. gallus*; and p. 179, pl. 91, fig. 890, which was called "Pugil tricornis in juventute.") I have referred at length to these several figures as they were used for "varieties" of *gallus* by many authors up to the time of Lamarck. It is unnecessary to elaborate on this use and I confine myself to two examples.

Gmelin (1791, p. 3511) divided *gallus* into 10 "varieties," only his main species and possibly his "variety α" being *gallus*, the rest being referred either to one or another of the Martini figures listed above or to figures from other iconographies showing related species. His "variety β," for instance, was referred to the Martini figures 836–837, which I believe represent Link's *Lambis curruca*, as Link referred to Gmelin's "variety." "Variety α" (the second listing of "α" in the synonymy) was based on Argenville's figure (1742, pl. 17, fig. K) which may be a highly stylized figure of an immature *gallus* but resembles *tricornis* much more closely.

Dillwyn (1817, pp. 662–663) also listed *gallus* with a "variety" described as "with three pointed knobs on the body whorl." Based on the figures he cited, this was certainly *S. tricornis* Humphrey.¹

Deshayes and Milne-Edwards (1835–1845,

vol. 9, p. 690) settled once and for all the question of the supposed great variability of *gallus* by eliminating all the so-called "varieties" in citing the treatment of the species by Gmelin and Dillwyn as "*variet. exclus.*," thus limiting *gallus* to the distinctive shell we know by that name. Since that time the species has enjoyed an uneventful nomenclatorial history and has acquired no synonyms. In fact the species shows little variation except in the length of the produced wing of the lip.

The species, however, is much closer to *Strombus raninus* Gmelin than to any of the other species that have been confused with it. That species shows only a slight extension of the lip, and has, unlike *gallus*, heavy folds at the upper parietal corner of the aperture. It also has two large spines on the body whorl,² the other spines, which are from this point mere rounded tubercles, being very much smaller than those of *gallus*, which has three very prominent pointed spines and three to five tubercles decreasing in size towards the parietal side of the aperture.

Linnaeus gave no locality for *gallus*. Many of his immediate successors located it not only in the western Atlantic but in Asian waters as well. This error possibly stemmed from Martini's remark (*tom. cit.*, p. 139): "This shell is not only native to Asia; the most beautiful [specimens] occur in America." Of the pre-Linnaean writers, those who gave any locality called it merely "Ailée américaine." Dillwyn was one of the few early post-Linnaean writers who restricted it to the western Atlantic ("Jamaica, Barbados, and Martinique"). Even as late as 1847, Sowerby queried its presence in both regions by giving its locality as "Asia and America?" and Reeve, in 1850, gave the Red Sea as its home.³

¹ This species was listed by Lamarck (1822, vol. 7, p. 201) under the name *tricornis*, but with no reference to Humphrey's use of the name, although he cited the Martini figures 843–845. *Strombus tricornis* also has the upper end of the lip produced into a wing, which, however, unlike that in *gallus*, is never higher than the spire.

² This feature is responsible for the specific name *bituberculatus* given to the shell by Lamarck (1822, vol. 7, p. 202). Gmelin's name, however, has 31 years' priority.

³ On this locality Tryon said (1879–1888, vol. 7, p. 113), "Reeve and some earlier authors have given the Red Sea as locality for this species, which is an error; probably originally caused by confounding it with *S. tricornis*."

It is a purely western Atlantic species, its range being from the Bahamas through the West Indies south to Brazil.

It is represented in the Linnaean collection in London by a specimen of the *S. gallus* of all authors, marked by Linnaeus.

The description in the "Museum Ulricae" is merely confirmatory of the identification. The only questionable item is the phrase "Spirae anfractus nodis obsoletis." In fresh specimens the nodes on all the whorls of the spire, with the possible exception of the anterior whorl, are too well developed to justify the use of the word "obsolete." They are more or less sharply pointed and compressed horizontally. Three specimens of *gallus*, labeled with that name, are found today in the Uppsala collection. One of these shows well developed, moderately sharp spines on the spire; in the other two specimens the spines are reduced to rounded nodules. It is not possible to determine the extent to which the shells had been worn from the photographs seen by the present writer on the microfilm of the collection.

Strombus gallus is figured by Reeve (1843-1878, vol. 6, *Strombus*, pl. 9, sp. 18); by Sowerby (1847-1887, vol. 1, *Strombus*, pl. 10, figs. 108, 111, dorsal and ventral aspects); by Swainson (1821-[1822], unnumbered plate, dorsal and ventral aspects); by Kiener (1834-1850, vol. 4, *Strombus*, pl. 9); and by Abbott (1954b, pl. 5, fig. e).

Strombus auris-dianae

1758, *Systema naturae*, ed. 10, p. 743, no. 429.

1767, *Systema naturae*, ed. 12, p. 1209, no. 497.

LOCALITY: "In O. Asiae" (1758, 1767).

"S. testae labro antice mucronato, dorso muricato, cauda erecta acuta . . . Labrum fauce incarnata."

The short subdescription was added in the twelfth edition. The description should be read in connection with that of *S. gallus*, the preceding species, as the contrasting details of the two diagnoses were designed by Linnaeus to bring out the specific distinctions between the two. The lip of *gallus* is aptly described as "mucronato longissimo," whereas that of *auris-dianae* is merely "mucronato," thus differentiating the long wing of the one, which extends higher than the apex of the spire, from the usually shorter wing of the

other, which typically rises only to the height of the penultimate whorl of the spire. In many individuals of *auris-dianae*, however, the wing equals that of *gallus* in length. In other details the present species may be distinguished from *gallus* by the constantly pink to orange-red color of the recesses of the aperture and by the greater dilation of the lip in *gallus*. The shoulder sculpture of *gallus* is described as "dorso coronato"; that of *auris-dianae* as "muricato." This is not a particularly happy comparison, however, as the two words are not antithetical. The word "coronato" has no connotation of shape, while "muricato" means "pointed." Both species are coronated just below the shoulder of the body whorl. In *gallus* this coronation consists of three large pointed spines, compressed horizontally, and several much weaker ones. In *auris-dianae* the coronation is merely a series of much weaker and less pointed spines, gradually decreasing in size. The canal is described as "recta" in *gallus* and "erecta acuta" in *auris-dianae*, but the canal of the latter is no more acute than in *gallus*, neither is "erecta," and the canal in *gallus* is not "recta." The only difference is that in *auris-dianae* the canal is more markedly deflected backward. Thus, of the distinguishing characteristics mentioned in the description, Linnaeus used ill-chosen words for all but one, the color of the aperture. Dillwyn (1817, p. 664) was even more explicit in calling the color orange. Lamarck's phrase "aurantio nigricante" is less characteristic, although the color shows very marked changes in this species, depending on the age and condition of the shell.

Any deficiencies in the description are, however, cured by an entirely correct synonymy. Hanley (1855, pp. 268-269) criticized it as being a composite of two species, *S. guttatus* Kiener, 1843, which he attributed to Reeve, and *S. lamarckii* Sowerby, 1847. He identified the Rumphius figure (pl. 37, fig. R) and that from Klein (pl. 6, fig. 106) with *lamarckii*. The Gualtieri figure (pl. 32, fig. H) and the Argenville figure (1742, pl. 17, fig. O) he allocated to *guttatus*. Of the Seba figures added in the twelfth edition (pl. 61, figs. 1-4, and pl. 62, fig. 13) those on plate 61 were referred by him to *guttatus*, while the

single figure on plate 62 was of *lamarckii*. Thus six of the nine figures he identified with *guttatus*. He also called attention to the fact that, of the three figures cited for the species in the "Museum Ulricae" (Rumphius, Gualtieri, and Argenville), the last two represented *guttatus*. Because of the preponderance of figures of *guttatus*, together with the fact that "the name was avowedly taken from Argenville (he calls it 'Oreille d'Ane'! a slight difference), and that Sowerby was the earlier in separating the previously confused species, it seem desirable to adopt his views." A more specious taxonomic reasoning can scarcely be imagined. I have several times in these papers deplored Hanley's habit of identifying a species with the one that was represented by a majority of figures in a synonymy. His argument as to Argenville's name is equally unsound. The change from the name "Ass's Ear" to the more pleasing "Ear of Diana" is of no importance in the identification of the species, and, indeed, the fact that Argenville first called it by any particular name has no weight whatever. Moreover, he was in error as to Sowerby's role in the restriction of the species. Sowerby did not mention the name *guttatus* in the "Thesaurus." He cited *auris-dianae* and *lamarckii* as distinct species (1847-1887, vol. 1, p. 35, pl. 9, figs. 101-102 for the first and figs. 88, 93, 98, 99 for the second). An examination of his description and figures shows that he considered that the name *auris-dianae* should be given to the smoother shell and *lamarckii* to the more highly sculptured form. In the attribution of names to the two forms all authors did not agree. Kiener, for instance (1834-1850, vol. 4, pp. 24-25, pl. 15, fig. 1, and pl. 16, fig. 1), gave the name *auris-dianae* to the more roughly sculptured shell and *guttatus* to the smooth. He did not cite *lamarckii* and incorrectly quoted Sowerby as having used *guttatus*. Sowerby admitted that "some varieties, however, occur, which connect the two species very closely." Hanley may perhaps be excused for his error in thinking that the species was composite, as that was the prevailing opinion of his day, and, moreover, he found specimens of what he then called *guttatus* and *lamarckii* in the Linnaean collection in London, both marked by Linnaeus for *auris-dianae*.

Reeve (1843-1878, vol. 6, *Strombus*, pl. 14, sp. 33) did not mention *lamarckii*, but cited both *auris-dianae* and *guttatus* as good species, saying of the latter: "Martini well-distinguished this species from the true *auris-dianae* which is roughly ribbed and ridged. The *S. guttatus* is conspicuously characterized by its smooth polished surface of a pinkish-fawn colour, sprinkled with irregular flakes of white; and it is remarkable for its copious deposit of enamel, which flows over the spire even to the apex." Deshayes and Milne-Edwards (1835-1845, vol. 9, pp. 694-695), in a footnote, went into great detail as to the confusion in the synonymy of Linnaeus and the treatment of the several names by later authors. The footnote, however, is unintelligibly phrased, and I am unable to decide what conclusion they reached. At least it is clear that they adopted the current theory that the several species were distinct.

On the opposite side of the ledger, neither in Wood's "Index," 1818, nor in Hanley's later edition of that work, 1856, is there a mention of *guttatus* or *lamarckii*.

Tryon specifically united the three names (1879-1888, vol. 7, p. 113, pl. 4, figs. 37-38). He listed only *auris-dianae*, placing both of the others in its synonymy. As to *guttatus* he said: "Attempts have been made to separate the smoother form as *S. guttatus* Martyn, but any considerable collection embracing specimens from several localities will demonstrate its identity with the more nodose form." Since his day the three names have been generally united in one species, although old collections still label certain forms as *guttatus* and *lamarckii*, and the two names are not always given to the same form.

I have discussed the earlier confusion purely for its historical significance, although the question has now become academic. The names *auris-dianae*, *guttatus*, and *lamarckii* are conceded by modern workers to represent merely forms of a somewhat variable species which should take the earliest name, *auris-dianae* Linné.

In common with many other commentators of the last hundred years the present writer had long considered *Strombus melanostoma* Swainson, 1825, as a dark form of the same species. A study of a considerable series of

that shell, however, shows that it should be considered a good species. It is constantly larger than *auris-dianae*, with a wing which almost reaches the apex of the spire and in many individuals exceeds it in height. Its color is darker throughout, especially in the parietal area and the inner side of the wing, becoming almost black in many specimens. The outer edge of the lip is heavily striped in dark brown, in contrast to the faint quadrate spots on the lip of *auris-dianae*, and these stripes are often doubled. The aperture is slightly ridged, particularly in the portion near the posterior canal, in contrast to the smooth aperture of *auris-dianae*.¹

The description of *auris-dianae* in the "Museum Ulricae" seems to combine the characteristics of the roughly sculptured and the smoother form of the shell. Hanley (1855, p. 269) characterized it thus: "The language of the 'Museum Ulricae,' upon the whole, favors *guttatus*; for although 'transversim striata' is more characteristic of the rougher *Lamarckii*, yet both have transverse (spiral) sculpture, whilst 'fauce glabra' and 'exiens in acumen subcarinatum longitudine spirae'

¹ Another species has been confused both with *auris-dianae* and with *melanostoma*. It is *Strombus pacificus* Swainson, 1821, a shell first described by Chemnitz (1780-1795, vol. 10, p. 210, pl. 156, figs. 1485-1486), under the name of "Auris Dianae Zelandiae novae." The name was used later by Deshayes and Milne-Edwards (1835-1845, vol. 9, p. 714) as "Strombus pacifique," *Strombus Novae Zelandiae*, and attributed to Chemnitz. They placed *S. pacificus* Swainson in its synonymy. The species is very close to *melanostoma*, but is principally distinguished by these details: It is much smaller, although larger than most specimens of *auris-dianae*. The orange color of the aperture of *melanostoma* is replaced by a pale yellow-brown, particularly in the recesses of the throat, and the deep blackish brown of the parietal area of that species and which there extends far up the side of the spire appears in *pacificus* only as a single large spot on the upper part of the columella. The ridges in the aperture, which are faint and almost obsolete in *melanostoma*, are deep and numerous in *pacificus*, fanning out from deep within the aperture and extending through the posterior canal, their interspaces being pale yellow-brown.

Tryon (1879-1888, vol. 7, p. 113, pl. 4, fig. 38) treated *novae-zelandiae* as a synonym of *pacificus*, and the latter name is generally considered today to be distinct from either *auris-dianae* or *melanostoma*.

I have used the name *pacificus* Swainson, as that is the name commonly found on our museum labels and referred to in the literature. The earliest valid name of the species is, however, *Lambis vomer* Röding, 1798, based on the Chemnitz figures of *Novae Zelandiae*.

can only conjointly be affirmed of its rival." The two specimens of *auris-dianae* in the Uppsala collection today are properly labeled. In one the wing is unusually long, reaching to the apex of the spire. In the other, it is short and may have been broken and the remainder worn. Both are of the roughly sculptured form.

The species is figured by Reeve (1843-1878, vol. 6, *Strombus*, pl. 14, sp. 33). *Strombus melanostoma* is figured by Reeve (*tom. cit.*, pl. 15, sp. 36a, b, and sp. 37). *Strombus pacificus*, as *novae-zelandiae*, appears on the same plate as species 35. The present species is also figured in Platt (1949, pl. 67, fig. 7).

Strombus pugilis

1758, *Systema naturae*, ed. 10, p. 744, no. 430.

1767, *Systema naturae*, ed. 12, p. 1209, no. 498.

LOCALITY: "Ad Jamaicam" (1758, 1767).

"S. testae labro antice prominente rotundato laevi, spira spinosa, cauda triloba obtusa . . . Faux rubra est, testa crocea."

Before any comments on the description are given, it should be noted that two species, *S. pugilis* Linné and *S. alatus* Gmelin (1791, p. 3513), have been confused. I believe them to be distinct species, although many workers have treated *alatus* as a subspecies of *pugilis* and this treatment has adherents today. Their ranges touch only in a very limited area. *Strombus pugilis* is typically a West Indian and Central American species, although it has been reported from as far south as Brazil. *Strombus alatus* is a species of the North American coastline, being found from North Carolina to both the Atlantic and Gulf coasts of Florida and westward in the Gulf of Mexico to Texas. The only locality common to both species is Lake Worth on the southeast coast of Florida and its immediate vicinity. This extension of range may represent a purely adventitious migration of *pugilis*, but, in any case, the two shells are so different in shape, sculpture, and coloring that it is difficult to avoid the conclusion that they are distinct species. No evidence has been presented indicating interbreeding of the two in the restricted area where both occur.

Clench and Abbott (1941, pp. 5-8) and Calvin Goodrich (1944, pp. 1-10) give exhaustive descriptions of both forms, to which

the reader is referred. In brief, *pugilis* is a shorter and broader shell than *alatus*. It bears a coronation of prominent spines at the shoulder of the body whorl and another series of even larger horizontally compressed spines on the last whorl of the spire. The spire has a series of sinuous spiral cords on each whorl, which carry in addition a row of rounded tubercles just above the suture. These are eight to 10 low transverse striations at the base of the shell, becoming obsolete anteriorly. The lip is patulous and somewhat alate in adult specimens, its upper edge slanting slightly upward from the horizontal into a rounded wing. This latter feature is a diagnostic character, which distinguishes *pugilis* from *alatus*. The inside of the lip sometimes shows a series of ridges or wrinkles, most evident at the base. The color of the shell is uniformly a rich salmon-orange, undecorated by the mottlings, bands, or zigzags that are seen in *alatus*. The aperture shows a deeper orange or in some individuals a pink flush disposed irregularly. The enamel of the parietal area is usually a deeper orange than the outside of the shell. The anterior end of the aperture is tipped with purplish brown. Periostracum is thin and grayish and velvety to the touch.

Strombus alatus has a longer, more slenderly conical body whorl and a higher spire than *pugilis*, although the height of the spire is variable. The coronation at the shoulder consists of smaller, less pointed spines than in *pugilis*, and the spines on the last whorl of the spire are still smaller, rather than larger as in *pugilis*. The wing of the outer lip is either horizontal or slopes downward. The basal region of the aperture is usually more rugose than in *pugilis*. The striations at the base of the shell are often stronger than in *pugilis*, although they show considerable variation in this respect. The sculpture of the base, consisting of a large rounded lobe between the stromboid notch and the sinus bordering the anterior canal, is virtually the same in both species. The color of the shell is typically a rich chocolate-brown, relieved in most specimens with sinuous vertical stripes of a paler brown or by one or more spiral bands which are most visible on the apertural side or by intermittent areas of zigzag lines of a lighter tan usually disposed irregularly on

the faint spiral bands. The parietal wall is highly glazed and of a much deeper brown than the rest of the shell, sometimes being almost black. This deep color is repeated at times in that portion of the aperture nearest the outer lip, although that area is sometimes a brilliant pink, particularly near the base. The whole color pattern is extremely variable.

It should be emphasized that considerable variation is found in *alatus* in each of the features mentioned above, and it might be justly said that the most striking feature of *alatus* is its susceptibility to variation, whereas the most obvious attribute of *pugilis* is its astonishing uniformity in shell characters.

It is doubtful whether the followers of Linnaeus, who did not have access to his collection, could have identified *pugilis* from its description alone. First, the expression "labro antice [*sic*] prominente rotundato laevi" is a very vague and equivocal way of describing the slightly uplifted wing of the species, and the wing is even less "rounded" than the wing of *alatus*. Secondly, the phrase "cauda triloba obtusa" is not clear. The "tail" itself is not in any sense lobed, and the entire base of the shell, if that is meant, shows only one lobe, or two if that part of the lip edge immediately above the stromboid notch was counted as a lobe. The phrase "spira spinosa" is also misleading, as only the last two whorls of the spire could with reason be called spinose, the upper whorls being sculptured with tubercles which develop into axial costae towards the apex. A reference to the sinuous spiral threads on the spire, which were mentioned in many later descriptions of the species, would have been a more useful aid to identification. The only fully characteristic phrase is the subdescription relating to color. The species was described in the "Museum Ulricaе," and there the defects of the "Systema" were largely cured by more elaborate descriptive language. Note particularly the phrases "basi striis elevatis," "Labium . . . breve, ut non aequet primum spirae anfractum. Lobo parvo obtuso, distincto sinu a spira," and "Lobus insuper postice [*sic*] distinctus a cauda." The only misleading expression in the "Museum" is "Faux glabra," which is not true in all cases. The presence or absence of rugae at the base of the aperture

is the only significant variation in the species. It is certain that the shell Linnaeus described in that work was *pugilis*. There is nothing in the description, or in the "Systema," which indicates that he had confused *pugilis* and *alatus*, or that he had ever seen a specimen of the latter. Indeed, all his writings show a considerable familiarity with West Indian shells, but, with a very few exceptions, he did not know the species restricted to the mainland waters of North America.

Linnaeus' synonymy is almost entirely correct. The figures from Buonanni (pl. 299), from Gualtieri (pl. 32, fig. B), and from Argenville (1742, pl. 18, fig. A) were all based on *pugilis*. Klein's figure, added in the twelfth edition, was a copy of another Buonanni figure (pl. 307). According to Hanley (1855, p. 269) this was "apparently designed for the *S. bituberculatus* of Lamarck [*S. raninus* Gmelin], which suits not the 'testa crocea' of the description." I am not so confident of this figure as was Hanley. The Lister figure (pl. 906, fig. 26) shows a monstrosity of *pugilis*, the spines of which are extremely large and much compressed laterally into square plates. Lister said of the figure: "It is probably nothing more than a *Lusus* of *Strombus pugilis*." The figure was erased by Linnaeus in the copy of the twelfth edition which he used in the preparation of his proposed "revised twelfth edition."¹

Linnaeus' early followers were prone to confuse the two species. *Strombus alatus* was described by Gmelin (1791, p. 3513), immediately after his description of *pugilis*, merely by changing the phrase "spira spinosa" to "spira inermi." In this he was only partially correct. The spire of *alatus* is merely less spinose than that of *pugilis*. The two last

whorls, however, are either spinose or tuberculate in all specimens examined by the present writer. Gmelin's added subdescription is otherwise very revealing and is entirely characteristic, if it is realized that he was describing a single specimen of this very variable species. It reads: "Testa fusca: fascia alba fusco maculata, spira alba fusco radiata et undulata, ventre et columella dilute badiis, cauda incarnata, fauce alba, labro intus fusco caeruleo rubroque nitente, ad marginem incarnato, dorso laevi ad basin tuberculis subacutis coronato." The description is supported by a poor figure from Martini (1769-1777, vol. 3, p. 182, pl. 91, fig. 894) and a characteristic figure from Schröter (1783-1786, vol. 1, p. 454, pl. 2, fig. 14). He gave no locality. Those persons following Gmelin were apt either to admit *alatus* as a variety of *pugilis* or to omit it altogether. Dillwyn (1817, pp. 664-665), used it for his "variety B" of *pugilis*: "Brown, with a band of white spots, and the spire unarmed," thus following Gmelin's misleading phrase, although his elaborate subdescription suggests that he must have seen specimens. He cited for "variety B" the Gmelin reference, as well as the two figures cited by the latter. His long subdescription covers several forms of *alatus* as well as *pugilis*. Lamarck (1822, vol. 7, pp. 204-205) listed both species but changed the name of *alatus* to *pyrulatus*, which called forth the following comment by Deshayes and Milne-Edwards (1835-1845, vol. 9, pp. 696-697, footnote): "This is another species whose specific name was uselessly changed by Lamarck; it should resume that of *Strombus alatus* which Gmelin first gave it." Lamarck did not comment on the difference in the slope of the upper edge of the lip which is often a distinguishing feature of the two species. Dall (1890-1903, pt. 1, p. 174) treated *alatus* as a variety of *pugilis*. He also attempted to join them by a series of intermediates, saying of *pugilis*: "To the north, and especially in the Floridian region, this becomes larger, maculated with dark brown bands, zigzags, or even entirely brown; the tubercles are less marked relatively to the size of the shell, and in the variety *alatus* disappear altogether." It is evident that Dall was merely describing the great variation in *alatus* without connecting that species de-

¹ Lister's specimen is still preserved in the British Museum (Natural History), where it is contained in the collection of Sir Hans Sloane. Leach (1814, p. 52, pl. 22, two figs.) elevated this monstrosity to the rank of a good species which he called *Strombus sloanii*. Wilkins (1952, p. 255) noted that it had been suggested that "the name [*pugilis*] was first applied to Lister's figure, normal forms only coming to the author's notice later. The shell certainly gives the impression of protruding fists, to which the name *pugilis* would apply admirably." The name was, of course, given to the species for quite another reason, namely, the active nature of the animal, which, when the shell is handled, apparently endeavors to strike with its foot armed with a sharply pointed operculum.

scriptively with the almost constantly uniform *pugilis*. The present writer has not seen a single Recent specimen of *alatus* that does not bear either tubercles or spines. Moreover, even though the fossil *alatus* is usually completely spineless, it is evident from the context of Dall's remarks that he was discussing the species as it is found Recent.

Strombus pugilis is the type species of *Strombus* Linné, by subsequent designation, Montfort, 1810. Dall (1890-1903, pt. 1, p. 173) apparently did not know of the earlier designation or ignored it. He selected *pugilis* as type species and, moreover, based his choice on the fact that Lamarck, in the "Prodrome" of 1799, had used it as the "example" of *Strombus*, which was not a valid designation under the terms of Article 30, section 2, of the Code of Zoological Nomenclature.

Unless *alatus* is to be considered conspecific with *pugilis*, the only synonyms of the Linnaean species are *S. sloanii*, above mentioned, and *S. peculiaris* Maxwell Smith, 1940, based on a specimen from Florida which, from the figure supplied by Smith, seems identical with Lister's monstrosity. Dall (1890-1903, pt. 1, p. 177) lists the following names of fossil species as being synonymous with *pugilis*: *S. ambiguus* and *S. proximus* Sowerby, 1850; *S. pugiloides* Guppy, 1874; and *S. proximus* Guppy, 1876. Dall, who treated *alatus* as a variety of *pugilis*, reports that both occur in the Pliocene of Florida, *pugilis* being spinose and *alatus* without spines, the latter being by far the more common.¹

Strombus pugilis is figured by Reeve (1843-1878, vol. 6, *Strombus*, pl. 16, sp. 39), and by Kiener (1834-1850, vol. 4, *Strombus*, pl. 20, figs. 1, 2). The figures in the "Tableau encyclopédique" (pl. 408, figs. 4a, b) show the shell characters of the species fairly accurately but are of a sinistral shell. *Strombus alatus* is figured in Kiener (*tom. cit.*, pl. 19, fig. 1, dorsal and ventral aspects) as *S.*

¹ The present writer has not found *pugilis* in the Caloosahatchie marl (Pliocene) in central and west Florida, but in the large series of *alatus* collected in that horizon the spines on the body whorl are completely lacking, except in one specimen where three low, almost obsolete spines are seen. The transition from spineless to spined forms of *alatus* had apparently already begun in the Pliocene, but the two forms are so strikingly different that the spineless shell may deserve a new name.

pyrulatus Lamarck, and in Swainson's "Exotic conchology" (1841, second ed., pl. unnumbered). Excellent colored photographs of both species are found in Abbott (1954b, pl. 5, figs. g and h). These clearly show the characters of *pugilis* and of one form of *alatus*. The Martini and Chemnitz figures are, with one exception, unsatisfactory. Martini (1769-1777, vol. 3, p. 122, pl. 81, figs. 830-831) shows two figures that he called "*Alata aculeis armata*" and referred to the *pugilis* of the "Systema" and the "Museum Ulricae." They are recognizable as *pugilis*. On plate 90 of the same volume the figures 882-883, which he called "*Alata rubra mutilis*" on page 174, were possibly based on an adult (882) and an immature specimen of *pugilis*, but the spines on the body whorl of the adult are by far the largest. The figures were not referred to *pugilis* Linné. Figure 882 was cited by Dillwyn (1817, p. 665) for the juvenile *pugilis*, undoubtedly in error for figure 883. Another Martini figure (*tom. cit.*, p. 182, pl. 91, fig. 894) was given no name nor supplied with any references but has the general contours of *alatus*. It has an almost black periostracum. The single figure supplied by Chemnitz (1780-1795, vol. 10, p. 215, pl. 156, fig. 1493) was cited by Dillwyn (*loc. cit.*) for his variety C of *pugilis* and by Deshayes and Milne-Edwards (1835-1845, vol. 9, p. 696) for *pugilis*. It was called "*Pugil duplicatus*" by Chemnitz. It is a monstrosity of *pugilis* with the spines of the shoulder of the body whorl and some of those on the last whorl of the spire doubled. I have seen no further references to this monstrosity.

A properly marked specimen of the *pugilis* of authors is found in the Linnaean collection in London. It was undoubtedly the more ample description in the "Museum Ulricae" that was responsible for the early identification of the species. A specimen is present in the Uppsala collection labeled *S. pugilis*.

Clench and Abbott (1941, p. 8, pl. 6) described and figured a form *nicaraguensis* Fluck, 1905, which they treat as a good subspecies of *pugilis*. It is distinguished from the typical *pugilis* by its much smaller size and by having the spiral sculpture of the young shell retained in the adult and covering the entire body whorl. In color it suggests typical *pugilis*, but its spines are smaller and fewer

and in this respect it resembles *alatus*. This subspecies is known only from the type locality, the beaches between the Principolka and Wawa rivers on the Mosquito Coast of Nicaragua.

Strombus gracilior Sowerby (1825, app., p. 20), figured by Tryon (1879–1888, vol. 7, p. 109, pl. 2, fig. 17) is the Pacific analogue of *pugilis*. I have taken the word "analogue" from the listing of *gracilior* in Grant and Gale (1931, p. 755) but it has characteristics of both *pugilis* and *alatus*. Its color is even lighter than that of *pugilis*, being a pale yellow rather than the salmon or orange of the latter. Its shape is that of *pugilis*. In three respects, however, it resembles *alatus*: the upper edge of the lip slopes downward from the horizontal even more abruptly than in most species of *alatus*; in the young shell one or more spiral bands of white encircle the body whorl, and vestiges of these bands sometimes are retained in the adult; in its coronation of spines it resembles *alatus*, being devoid of the massive spines seen on the last whorl of the spire and the body whorl in *pugilis*. It may also be distinguished from *pugilis* by its constantly white aperture and by the fact that the spiral threads seen in that shell (and in *alatus*) are here confined to the first four post-nuclear whorls of the spire. *Strombus gracilior* is found Recent from the Gulf of California to Ecuador, as well as in the Pliocene of Imperial County, California, and in the lower and upper Pleistocene of Baja California. A detailed study of large series of this shell in various life stages as compared with similar series of the two western Atlantic species, and a consideration of the geological changes that may have been responsible for the migration of what may turn out to be a parent stock, would be necessary to determine its true taxonomic position. Based on gross shell characters alone, *gracilior* seems to be an intermediate between *pugilis* and *alatus*.

Strombus marginatus

1758, *Systema naturae*, ed. 10, p. 744, no. 430.

1767, *Systema naturae*, ed. 12, p. 1209, no. 499.

LOCALITY: Not given in either edition.

"S. testae labro prominulo, dorso marginato laevi, cauda integra."

This species was not on the list of shells owned by Linnaeus and no specimen so marked, nor any specimen that can be said to conform to the brief description, is to be found in his collection in London.

We may assume that the specimen described was borrowed, or that he obtained his description from a fellow conchologist. The description is hardly informative enough to identify the shell on which it was based. There is no synonymy nor locality to support it. The phrase "dorso marginato," however, persuaded Schröter (1783–1786, vol. 1, p. 431, pl. 2, fig. 10) that Linnaeus' *marginatus* was the shell that he figured under that name and that has become the *marginatus* of all authors. Hanley (1855, p. 270) said of this choice that it "so excellently agrees with the brief description that his selection has met with universal assent." The words "dorso marginato" probably refer to the fact that the shoulder of the shell is markedly angulated and defined with a raised and minutely nodose white line, although the quoted words are not particularly well chosen to describe this keeled shoulder.

Dillwyn, however, disagreed with Schröter's conclusion. He said (1817, p. 665) "Schröter, Gmelin and Chemnitz appear to have mistaken *S. accinctus*¹ for this species, and a shell which Mr. Humphreys sold me under the name of *S. marginatus*, answers better to Linnaean definition; it is about sixteen lines long, and half as broad, and the spire occupies about two-fifths of the length; the color is pale chestnut or fawn-color, slightly mottled with white, and the margin of the aperture and the pillar are white; both the lips are much thickened, and their pointed terminations are attached to the second whirl of the spire; the aperture is yellow." I have quoted Dillwyn's comments at length in order to point out two errors. First, Schröter did not mistake *accinctus* (error for *succinctus* Linné) for *marginatus*, as both his description and his figure clearly point to

¹ *Strombus accinctus* is a name that resulted from a misreading by Born of an error in the printing of the name *Strombus succinctus* in the twelfth edition of the "*Systema naturae*." The error is explained and its consequences are discussed under *S. succinctus* Linné (p. 279 below).

marginatus. Second, Dillwyn's description of the shell obtained from Humphreys (error for Humphrey) is a good description of *succinctus* in all but a single detail: the mention of the color as "mottled with white" does not conform to the pattern of *succinctus* which shows, on a pale fawn background, four spiral bands of white decorated with dashes of the background color. This color pattern is, however, somewhat variable. It should be noted, however, that the color pattern of *marginatus* is much like that of *succinctus*. In fact the shells have many features in common, *marginatus* being readily distinguishable however, by its shorter, more conical shape and the strong angulation of its carinate shoulder.

As to Dillwyn's stricture on Chemnitz' conception of the species it is difficult to say whether or not he was justified in making it. Chemnitz' diagnosis of *marginatus* in 1788 (1780-1795, vol. 10, pp. 212-213, pl. 156, figs. 1489-1490) referred the species to both the *marginatus* of the "Systema" and the "Museum Ulricae" and to Schröter's good figure, and gave it the graphic German name of "Die Scharfrand." He himself supplied two figures which are unmistakably *marginatus* and show a keeled shoulder. Chemnitz also referred to an earlier figure from Martini (1769-1777, vol. 3, p. 105, pl. 79, fig. 816) which the latter had called "*Alata Canarium latum*" and specifically referred to the *succinctus* of the "Systema." Chemnitz said: "My worthy predecessor has pictured this species in the third volume of this work at figure 816 and described the same adequately on page 105. However, the figure is very bad and equivocally drawn, so that the late Martini unfortunately did not know or did not notice that he had *Strombus marginatus* in his hand. Thus he had considered the shell as nothing more than a variety of *Strombus succinctus* Linné." It is probable that Dillwyn was thinking of Martini's vague figure and his reference of it to the *succinctus* of the "Systema," rather than of Chemnitz' good figures and description of *marginatus*, and that he had not read Chemnitz' text explaining Martini's error.

The Martini figure, although referred to *succinctus* Linné, is not an unequivocal draw-

ing, but Chemnitz was possibly justified in calling it *marginatus*. Its shape is that of *marginatus*, and the shoulder is slightly angulated. The detail that Chemnitz did not mention is that Martini supplied two figures for his *succinctus*. The other, figure 815, is clearly the latter shell in its narrower outline and rounded, unkeeled shoulder. Martini did not mention *marginatus* anywhere in his work, and it seems probable that the two specimens figured were considered by him to be forms of a single species, and one wonders why Chemnitz did not call attention to the discrepancy in his predecessor's plate. The omission casts a scintilla of doubt on Chemnitz' own conception of the species.

As to Gmelin's supposed error in identification, Dillwyn was incorrect. Gmelin (1791, p. 3513) first copied Linnaeus' description of *marginatus* and cited the good Chemnitz figures of *marginatus* above mentioned and Schröter's good figure. From Martini he took only one figure, figure 816, which was probably based on a specimen of *marginatus*. Any question as to what he was describing is answered by his long and graphic subdescription which contains the significant phrase "*anfractibus 4 primis marginatus*." This view of Gmelin's conception of the species is, it is admitted, somewhat impugned by his later citation of both of Martini's figures 815 and 816 in his synonymy of *succinctus* on page 3518, although his description of *succinctus* is characteristic.

The diagnoses, then, of two of the three writers criticized by Dillwyn are not, I confess, entirely free of doubt. The fact that the two species have so many traits in common, together with the mediocrity of some of the cited figures, may have been the cause of the apparently equivocal items in these diagnoses. One further fact should be noted: While Dillwyn's main description, containing the words "transversely keeled, slightly nodulous," is a good description of the *marginatus* of all authors, his description of the shell obtained from Humphrey, which he called *marginatus*, omits any reference to the angulation or keeling of the body whorl and is, as written, an almost perfect description of *succinctus*.

The Linnaean description of *marginatus* is

brief and omits many important details of the shell. It has, however, been deemed sufficient by modern writers to point to the shell called *marginatus* today, in spite of its brevity, the lack of a synonymy or locality, and the absence of a type in the Linnaean collection. It was not described in the "Museum Ulricaë," and no specimen of it is present in the collection at Uppsala.

The best figure is found in Reeve (1843–1878, vol. 6, *Strombus*, pl. 18, sp. 49).¹

Tryon (1879–1888, vol. 7, p. 116) gives *S. robustus* Sowerby [?1874] as a synonym of *marginatus*. It is difficult to determine just what Sowerby was describing. His description omits any reference to the keeled shoulder of the shell, which is the most important diagnostic characteristic of *marginatus* and the one that gave the shell its name. Indeed he said "anfractibus rotundatis" and, in his English subdescription, "whorls rounded." He supplied two figures (pl. 72, figs. 5, 5a). One of them shows a well-rounded shoulder, and the other appears to have an angulated shoulder which is slightly nodose. I have seen but two specimens labeled *S. robustus* Sowerby, and they were not specimens of *marginatus*. They were like it in all respects except for an evenly rounded shoulder. Nor were they *succinctus*. If the labeling was correct and this was the shell called *robustus* by Sowerby, then Tryon's statement was incorrect.

Strombus luhuanus

1758, *Systema naturae*, ed. 10, p. 744, no. 432.

1767, *Systema naturae*, ed. 12, p. 1209, no. 500.

LOCALITY: "In O. Asiae frequens" (1758, 1767).

"S. testae labro prominulo, dorso laevi, anfractibus rotundatis aequalibus . . . Faux sanguinea."

As a definition of a shell so distinctive in appearance as the *S. luhuanus* of all authors, the above description is woefully inadequate. The most obvious diagnostic characters of

¹ Reeve (*loc. cit.* in text) called attention to the difficulty of the early conchologists in distinguishing between *marginatus* and *succinctus*, saying: "It is not possible to decide whether the shell which Lamarck and others referred to the Linnaean species is the correct type . . . *S. marginatus*, though differing so materially in form, has very much the appearance of a longitudinally compressed variety of *S. succinctus*."

the species are omitted: the almost black stripe on the columella, the broad bands of brown zigzags on the body whorl, the rounded shoulder uplifted in its dorsal portion, the deeply channeled suture, the peculiar spire, the last whorl of which is smooth and gibbous and the upper whorls deeply plicate, and the thick, everted outer lip with its slightly uplifted posterior wing and deep stromboid notch. The words "labro prominulo" are hardly adequate to cover the several peculiar features of this easily described lip, and the phrase "anfractibus rotundatis aequalibus" is insufficient to give any true picture of the unusual development of the shoulder and spire.

It was undoubtedly the accuracy of all except one of the figures in the synonymy that led to the early identification of the species by naturalists to whom neither Linnaeus' collection nor his own manuscript additions to the synonymy were available. Both the Rumphius figure (pl. 37, fig. S) and the several Seba figures (pl. 61, figs. 20–21, and pl. 62, figs. 31–32) show the *luhuanus* of authors. Argenville's figure (1742, pl. 17, fig. N) was said by Hanley (1855, p. 270) to represent *S. gibberulus* Linné, the next species in the "Systema," and, although the figure is only a dorsal view, so that the aperture is not visible, I am inclined to agree.² (See *S. gibberulus*, p. 265.)

Deshayes (1830, 1832, vol. 3, p. 990) treated *Strombus mauritianus* Lamarck, 1822, as a variety of *luhuanus*, but in the second edition of Lamarck's "Histoire naturelle"

² Argenville said of his figure (1742, p. 195): "The shell lettered N is slightly humpbacked (bossue) in the contours of its upper portion; the lips are sometimes red and sometimes black, whence the name 'black throat' (gueule noire) has been given to it." The last part of this sentence is equivocal. All specimens of *luhuanus* show a black columellar stripe, with the rest of the aperture pinkish orange. The columella of *gibbosulus* is typically white, although in rare specimens it has an irregular blackish brown streak. The color of the inner side of the lip and the rest of the aperture in *gibberulus* is very variable, and this variation is not always due to age or bleaching. It varies from a pale brown to pink, violet, or purplish brown, the color being usually strongest along the band of ridges parallel to the lip. It is possible that Argenville had confused the two species, but used a specimen of *gibbosulus* for his figure.

Deshayes and Milne-Edwards (1835–1845, vol. 9, p. 698, footnote) reverted to Lamarck's original opinion that the two species were distinct. Lamarck's species seems easily differentiated. Its columella is always white, and it lacks the slightly uplifted posterior wing of the outer lip.¹

Tryon (*loc. cit.*) cited *Strombus labrosus* Menke, 1829, and *S. laevilabris* Menke, 1830, as synonyms of *luhuanus* Linné. Menke's 1829 work was not available to the present writer (see Bibliography), but *laevilabris*, 1830, based on the Chemnitz figure (1780–1795, vol. 10, pl. 157, figs. 1499–1500) there cited, is certainly not *luhuanus*. The Chemnitz figures show a short lip, descending from the horizontal at the upper end and abbreviated below, as is the lip in *S. dentatus* Linné, a red aperture, and a colorless columella. I do not know what the figures represent. Chemnitz called his species "Varietas notabilis Strombi Luhواني, fauce sanguinea, columella haud nigricante." He located it, among other places, in Mauritius, and the figures possibly show *S. mauritianus*.

The Linnaean collection in London contains two specimens of the present species marked by Linnaeus. The description in the "Museum Ulricae" is, as usual, more informative than that in the "Systema." The

¹ Tryon (1879–1888, vol. 7, p. 122) first treated *mauritianus* as a good species, but concluded his comments by saying: "No differences of form which have been pointed out as distinguishing this and the preceding species [*luhuanus*], hold good when an extensive suite is examined. The only real distinction is the narrow black deposit overlaying the columella in *S. luhuanus*, of which *S. mauritianus* never appears to show even a trace." The present writer's comparison of adequate series of the two shells does not lead to the same conclusion. I feel that Tryon appears to have laid insufficient emphasis on the obvious and constant difference in the color of the columella and on the difference in the shape of the upper end of the lip which in *luhuanus* rises in a short wing and in the other drops in a descending curve. This and other differences make me unwilling to unite the two species. I have referred to the species as *mauritianus* Lamarck, as that name has been consistently used for the shell. It has, however, two possible earlier names. Its first validly proposed name is *Lambis decora* Röding, 1798, which was referred to a pair of Chemnitz figures (1780–1795, vol. 10, pl. 157, figs. 1499–1500) which are fair figures of the *mauritianus* of authors. It is also *Lambis miniata* Link, 1807, and *Strombus luhuanus* var. "γ" Gmelin, 1791, both of which were based on the same Chemnitz figures.

phrases "Labium obtusum, ad basin et apicem lato emarginatum, nec antice ad primum anfractum spirae adscendens," "Faux saturate purpurea . . . columella nigricans," and "labio intus striata" fill in several of the gaps in the original description. The last phrase quoted is somewhat misleading. The ridges on the inner side of the lip are fine and, as they are of the same color as the inner face itself, are in most specimens practically invisible. They become slightly more evident at the base of the shell. Two specimens, properly labeled, are present in the Uppsala collection.

The specific name *luhuanus* has only one synonym, the *Alatus coccineis* Humphrey, 1797, of the "Museum Calonnianum," although the species has been included from time to time in several generic or subgeneric groups, in addition to *Alatus* and *Strombus*: *Alata* Meuschen, 1787, *Lambis* Röding, 1798, *Strombella* Gray, 1857, *Aporrhais* Da Costa, 1778, *Canarium* Schumacher, 1817, *Strombidea* Swainson, 1840, and *Conomurex* P. Fischer, 1884.

The species is figured by Reeve (1843–1878, vol. 6, *Strombus*, pl. 9, sp. 19) and by Sowerby (1847–1887, vol. 1, *Strombus*, pl. 7, fig. 54). An examination of Reeve's figure of *mauritianus* on the same plate (fig. 20) clearly shows the difference between the two.

Strombus gibberulus

1758, *Systema naturea*, ed. 10, p. 744, no. 433.

1767, *Systema naturae*, ed. 12, p. 1210, no. 501.

LOCALITY: "In O. Asiae" (1758, 1767).

"S. testae labro prominulo, dorso laevi, anfractibus gibbosis inaequalibus . . . Latus inferius testae planiusculum est."

The description, which is the same in the tenth and twelfth editions of the "Systema," has been considered adequate to define the species, as it points out details not seen in combination in any other species of *Strombus*. An additional detail, "Faux atropurpurea," was added by a manuscript note of Linnaeus in his copy of the twelfth edition. It omits, however, many of the diagnostic features of this common and distinctive shell and, as I have not found a really comprehensive description, it is here redescribed:

Shell white with zigzag longitudinal lines of

dark brown, usually interrupted by four to six narrow, white, spiral bands. Outer lip thick and slightly inflected and with two projections at the posterior end, the upper of which is adherent to the last whorl of the spire. Parietal area white, heavily calloused, particularly at the posterior end of the columella where it forms a prominent knob. Occasional specimens show a moderate amount of brown stain on the columella. Aperture white, with a ridged area parallel to the lip edge, the color of this area being pink or violet to purplish brown. Body whorl smooth except for weak spiral striations. Spire with closely packed sinuous spiral cords. The last whorl of the spire extremely gibbous, giving the shell a humpbacked appearance. Dorsal face of the body whorl slightly flattened, which makes the shell seem broader when viewed from this angle than when seen from the apertural face. Stromboid notch deep and narrow.

The synonymy in the "Systema" is bad from the standpoint of draftsmanship, although all the figures (Rumphius, pl. 37, fig. 5; Buonanni, pl. 150; and Seba, pl. 61, fig. 53) are recognizable as showing *gibberulus*. Two slightly better figures from Seba (figs. 51–52) were not cited.

The earliest post-Linnaean figures of the species were those of Martini (1769–1777, vol. 3, p. 93, pl. 77, figs. 792–798). They are not good as to either color pattern or shape, but most of them, especially figure 795, show many of the diagnostic characters of the species. Martini called his shell "Alata canarium gibbosum" and referred it to the *gibberulus* of the "Systema."

In spite of this early identification of the species, it has received a number of other names. It is the *Alata pictus* Humphrey, 1797, of the "Museum Calonianum," the *Aporrhais albus* of Mörch's Yoldi Catalogue, 1852, and *Strombus mauritanus* Issel, 1869, not of Lamarck, 1822. Henry and Arthur Adams (1858, p. 260) listed *S. gibberulus* and a shell they called *S. albus* on the same page, but the latter is apparently merely a bleached example of *gibberulus*. The color of the species is extremely fugitive, and the great majority of specimens in collections are beach-worn and bleached white.

The specimen of *gibberulus* in the Linnaean

collection in London is unquestionably the type, as it is marked as such by Linnaeus. The description in the "Museum Ulricae," although more detailed than that in the "Systema," adds little to assist in the identification. In two respects it is either misleading or erroneous. It says that the lip does not reach to the first whorl of the spire ("antice [*sic*] non attingens anfractum primum spirae"), whereas the lip has a slightly raised posterior wing which is adherent to the body whorl or to the last whorl of the spire, depending on whether this feature is viewed from the back or front of the shell. It also says of the spire: "Spirae Anfractus dorso gibbosi, laeves." Linnaeus must have had before him a much worn shell, as all whorls of the spire are closely sculptured with revolving wavy threads which disappear or are only faintly visible in beach specimens. The "Systema" also omits any reference to the sculpture of the spire, or to color, and in the "Museum" the only reference to color is the "nigricans" of the aperture, a word that ill accords with the theory that the specimen was a beach shell. The specimen in London is too vaguely photographed for one to pass on either of these points. That in the Uppsala collection today, which is labeled *gibberulus*, does not show either color or the threads of the spire, although the photograph seen is clear and to that extent conforms to the description in the "Museum Ulricae."

It is difficult to find good figures of this species. Reeve's figures (1843–1878, vol. 6, *Strombus*, pl. 8, figs. 15a, b) are almost unrecognizable, and the figure in Sowerby (1847–1887, vol. 1, *Strombus*, pl. 6, fig. 19) is equally unsatisfactory. Mention must again be made of Argenville's figure (1742, pl. 17, fig. N). This is a good dorsal view of *gibberulus*, whereas it was cited for *luhuanus* by Linnaeus. Argenville's description of this figure should be read (see discussion under *S. luhuanus*, p. 264, above). The pair of figures in the "Tableau encyclopédique" are much stylized but barely recognizable as *gibberulus*. It is possible that the artist did not intend them for that species, however, as they are referred to in the "Liste" as *Strombus succinctus*, a name that, in spite of the opinion of some that it was not *succinctus* Linné, I believe to have been applied to the Linnaean

species. The best figure of *gibberulus* Linné is that of Kiener (1834–1850, vol. 4, pl. 28, fig. 1, dorsal and ventral aspects).

Strombus oniscus

1767, *Systema naturae*, ed. 12, p. 1210, no. 502.

LOCALITY: Not given.

"S. testa obovata cingulis nodosis, mucrone subulato laevi . . . Testa magnitudine coryli, obovata, cingulis tribus subnodosis: nodis ordine longitudinali itidem dispositis, pallida, maculis nigri-cantibus sparsis contaminata. Spira obtusissima cingulo solitario noduloso: apice tenuissimo albo. Apertura alba, longitudinalis, columella laevi; Labro exteriori vix repando. Cauda nulla et basis vix manifeste emarginata."

The above description, one of the longest of Linnaeus' definitions of mollusks, cannot be attributed to any species but the *Morum oniscus* of all modern writers. This common shell from the West Indies and southeastern Florida has been known to European naturalists since the beginning of the eighteenth century, at least, as Petiver (1702–1711, pl. 48, fig. 16) described and figured it. The name *oniscus* was, however, first used by Linnaeus.

The list of genera in which it has been contained from time to time is a long one for such a well-known shell. Lister placed it among the cassids, while Gualtieri conceived it to be a Cone. After its inclusion in *Strombus* by Linnaeus, Scopoli (1786, p. 78, pl. 24, fig. 3) listed it in *Cypraea* as *Cypraea conoidea*. Bruguière (1789, 1792, pt. 2, p. 432) returned it to the family Cassidae, using it in his new genus *Cassidea*. It was included in *Morum* by Röding in 1798 as *M. purpureum*, and it is generally and properly used in that genus today. It is the type species of *Morum* Röding, by monotypy. Link (1807, p. 112) erected another new genus, *Lambidium*, for its reception, of which it is also the type species, by monotypy. Lamarck (1822, vol. 7, p. 214) placed it in his *Cassidaria*. In 1824 Sowerby (1820, 1825 [1834], vol. 2, pl. 233, fig. 4) erected the genus *Oniscia* for *oniscus*.¹ The name *Oniscia* was adopted by Deshayes and Milne-Edwards in 1844 (1835–1845, vol. 10, p. 11), who included in it, in addition to *oniscus* Linné, two other species, *O. lamarckii*

Deshayes and *O. tuberculosa* Sowerby, 1824, the latter an eastern Pacific species that ranges from the Gulf of California to the Santa Elena Peninsula in Ecuador and the Galapagos Islands.²

In occasional specimens of *Morum oniscus* the upper row of nodules is definitely doubled. It was undoubtedly on such a specimen that Menke's *Oniscia quadriseriata* (1830, p. 64) was based. In some specimens each node in the upper row is divided by a shallow transverse sulcus, and there is a chain of intermediates between the double and single row in respect to the depth and definition of this sulcus. This feature does not justify any specific separability. Other than *quadriseriata* Menke, the only synonyms of *oniscus* are *Cypraea conoidea* Scopoli, 1786, *Morum purpureum* Röding, 1798, and *Oniscia triseriata* Menke, 1830.

Morum oniscus is found in a small area of southeastern Florida, on the Florida Keys, and in the West Indies, where it is common, and south on the South American coast to Brazil. It is a nocturnal form, found by day sheltering under slabs of coral rock (after Clench and Abbott).

No specimen of *Morum oniscus*, marked or unmarked, is present in the Linnaean collec-

² As to the first species, *lamarckii*, Deshayes and Milne-Edwards, in a footnote to *S. oniscus* (p. 10), said: "Linnaeus said, in his short description of this species, that it had a white aperture. Lamarck said that it was red; nevertheless he included in his synonymy figures of a shell whose aperture is always white. There are two species, very closely related, which are easily distinguished by the color of the aperture and the dentition of the outer lip. These species are always confused, and among the majority of authors it is this shell with the rosy aperture which is called *oniscus*; we separate it under the name of *Oniscia lamarckii*." They added a further footnote on the subject under their listing of *lamarckii* (p. 12), as follows: "This shell has a close relationship with the *Strombus oniscus* of Linnaeus. . . . In the latter [*lamarckii*] the aperture is always of a beautiful rose, and in *oniscus* this area is constantly white." The most recent comment on this complex is by Clench and Abbott (1943, p. 5): "The variety *lamarckii* Deshayes is, in our opinion, an absolute synonym of *Morum tuberculosum* Reeve of the Eastern Pacific area (Western Panama). Its size, coloration and shape agree in all details with specimens that we possess from the western Panamic area." Thus these writers adopt the view that *oniscus* and *lamarckii* are conspecific and that *tuberculosum* is merely a synonym of the form *lamarckii*. They use the name *tuberculosum* as of Reeve, 1842, as Sowerby's use of the name in 1824 was a *nomen nudum*.

¹ *Oniscidia* Swainson (1840, p. 228) was apparently a *lapsus calami* for Sowerby's *Oniscia*.

tion in London. It was not described in the "Museum Ulricaë."

The early figures of *oniscus* are unusually good (see Martini, 1769–1777, vol. 2, pl. 34, figs. 357–358; Chemnitz, 1780–1795, vol. 11, pl. 195A, figs. 1872–1873; both works showing dorsal and apertural aspects of the shell). Hanley supplied a good colored figure of the species (1855, pl. 5, fig. 3). It is well figured in Reeve (1843–1878, vol. 5, *Oniscia*, pl. 1, sp. 5a, b). The best recent figures are those of Clench and Abbott (1943, pl. 3, figs. 1–5, fig. 2 showing the immature shell).

Strombus lucifer

1758, *Systema naturae*, ed. 10, p. 744, no. 434.

1767, *Systema naturae*, ed. 12, p. 1210, no. 503.

LOCALITY: "Ad Americam australem" (1758, 1767).

"S. testae labro antice [*sic*] rotundato integro, ventre dupliciter striato, spira carinata: tuberculis superioribus minutis. . . Differt a sequenti testa minus crassa, et imprimis spinis spirae minimis, nec magnis crassis pollicaribus ut in illa. Conf. Gvalt. test. t. 55. f. B. an hujus Larva?"

The description of *lucifer* is identical in the tenth and twelfth editions of the "Systema" except for the addition of the last sentence of the subdescription in the twelfth.

It was established very early that the description covers merely the immature shell of the next species, *Strombus gigas*, the Pink Conch of the western Atlantic. The language of the description indicates that Linnaeus had before him a specimen in a fairly advanced stage of growth, as is shown by the phrase "labro . . . rotundato," and also reveals that he felt that *lucifer* and *gigas* were closely related. The fact that he listed them separately, however, is proof that, at least in 1758, he was not certain that they were mere growth stages of the same shell. The reference to the Gualtieri figure in the twelfth edition does not, in my opinion, indicate that he had changed his mind. That figure shows an immature *gigas*, with the first two spines on the body whorl fairly well developed but with the lip not yet expanded. The phrase "an hujus Larva?" would be more helpful if we knew whether he meant by "hujus" the shell shown in the figure or the shell on which he probably based his description of *lucifer*. In any case, the figure shows a specimen that is less mature than the specimen he probably

described for *lucifer*, as it does not have a "labro rotundato." It is also significant that in the twelfth edition he continued to cite the two names separately. The question is further complicated by his addition of a variety " β " for *gigas* in the twelfth edition, citing for it another Gualtieri figure (pl. 54, fig. M). This latter figure shows a shell somewhat less spinose than that in the Gualtieri figure cited for *lucifer*, although approximately in the same growth stage. He must have cited figure M for the young of *gigas*, in the face of his citation of an almost identical figure for *lucifer*. With all this evidence before Linnaeus, it is strange that he continued to list the two names separately. I do not believe that he was ever convinced that only one species was involved.

The only misleading phrase in the description is "ventre dupliciter striata." The young shell is spirally striate over the entire body whorl and spire, a feature that is persistent in all the young stages, but becomes almost obsolete in the mature shell except on the back of the expanded lip, but the striations in the young shell are merely narrower and closer together in the area just below the shoulder than they are below. The striations cannot be described as doubled on any part of the shell.

In the Linnaean collection in London we find a young specimen in the growth stage covered by the description, which is marked for *lucifer*, and another similarly marked for *gigas*. The two are so alike that Linnaeus' failure to recognize their common identity is unexplainable.

If Linnaeus' strange interpretation of these figures be disregarded, it is hardly surprising that he must have been led to think the two forms distinct. In *gigas* the more juvenile shell differs so radically from the adult in appearance, largely owing to the greater sharpness of the sculpture in the former and the remarkable development of the outer lip with its brilliant pink aperture in the latter, that an examination of a series of individuals in various growth stages is necessary to confirm their common identity. It is surprising, however, that Linnaeus chose only the young of *gigas* to bear a different name, as the young of all the broad-lipped species of *Strombus*, as well as all the species of *Lambis* in *Strombus*

Linné, differ markedly from the adult shells.

Röding (1798, p. 134) even placed *lucifer* in a different genus, *Pyramis*, citing for it *lucifer* Gmelin and a figure from Martini (1769–1777, vol. 3, p. 170, pl. 90, fig. 881) which shows *gigas* in the stage immediately preceding the development of the flaring lip, and which is much like the specimens in the Linnaean collection marked, respectively, for *lucifer* and *gigas*. Martini did not connect his figure in any way with *gigas*, but realized that it was one of the *Strombus* species that develop an expanded lip, as he called it "Cochlis alata imperfecta." He supplied a list of pre-Linnaean and post-Linnaean references, none of which gave any indication that *lucifer* was related to *gigas*, although the latter was a well-known shell to European naturalists as early as the sixteenth century, having been described by both Rondelet and Belon. Röding's conception of *lucifer* was all the more surprising, as Gmelin, whom he cited, had given him a hint of the truth in the language of his subdescription: "... spinisque longe minoribus armata, quam in Str. Gigante; nonne aetate minore solummodo ab hinc diversus?" As "nonne" is a word that asks a question to which an affirmative answer is expected, this is a much more emphatic suggestion than that of Linnaeus. Link (1807, p. 107) also placed *lucifer* in the same genus, but changed the name to *Pyramea*, although referring to the Röding spelling of the name. Both Born (1780, p. 281) and Schröter (1783–1786, vol. 1, p. 436) cited both *lucifer* and *gigas*, Born saying of *gigas*: "It differs from the preceding [*lucifer*] by its more ponderous shell and the stronger spines on the spire." Schröter said: "He [Linnaeus] cited Gualtieri's pl. 25. B and asked, 'perhaps *Strombus lucifer* is the young or a dwarf [*Stumpfschen*] of *Strombus gigas*.' I believe, and many will agree with me, that by comparing a sufficient series of specimens, one would surely see that the Franckehorn [*lucifer*] would gradually develop into *Strombus gigas*."

The first categorical statement that *lucifer* and *gigas* were conspecific was in Dillwyn (1817, p. 668). He cited *lucifer* only for the "Junior" of *gigas*, "with the outer lip not expanded." Lamarck omitted any mention of the name *lucifer*, but the editors of Lamarck's second edition of the "Histoire

naturelle," Deshayes and Milne-Edwards, said (1835–1845, vol. 9, p. 686): "Having carefully studied the synonyms and the short description which Linné gave for his *Strombus lucifer*, we think that it should be united with *Strombus gigas*." Since that date there has been no question but that the name *lucifer* should be dropped, except that the question was again raised by Reeve (1843–1878, vol. 6, *Strombus*, pl. 2, sp. 2), who said, in his text on *gigas*: "An eadem? *Strombus lucifer* Linnaeus."

The synonymy of *lucifer* in the "Systema" does not include any figure of the adult *gigas*. According to Hanley (1855, p. 271) it includes one figure, which he did not identify, of a young *Strombus* of another species. The present writer's examination of these figures leads to the conclusion that most of them are so badly drawn and apparently so discordant that they may well have been based on the immature shells of several *Strombus* species. Of all the eight figures cited, which it is unnecessary to discuss piecemeal, I would be willing to attribute to the young *gigas* only that from Argenville (1742, pl. 17, fig. I).¹

In addition to the Martini figure already cited, good figures of extremely young specimens are found in Clench and Abbott (1941, p. 1, pl. 1) and in Abbott (1954b, pl. 23, fig. a, small figure). Both are dorsal views.

The species was not described in the "Museum Ulricae."

Strombus gigas

1758, Systema naturae, ed. 10, p. 745, no. 435.

1767, Systema naturae, ed. 12, p. 1210, no. 504.

LOCALITY: "In America" (1758, 1767).

"S. testa labro rotundato maximo, coronata ventre spiraque spinis conicis patentibus. . . Testae color internus vividissimus."

The description, which is identical in the tenth and twelfth editions of the "Systema," was criticized by Hanley (1855, p. 272), by implication, as lacking in clarity. He seems to suggest that the most cogent evidence of identity was afforded by the specific name itself, as *gigas* is the largest of the *Strombus* species, at least of those known to Linnaeus. To the present writer, the description seems

¹ Argenville's figure K on the same plate, which was not cited by Linnaeus, shows the shell in a slightly more advanced stage of growth.

adequate to define the species. The phrase "labro rotundato maximo," combined with the mention of the coronation of spines, points surely to *gigas* and distinguishes it from the next species, *latissimus*, which, although its lip is also described as "rotundato maximo," is characterized as "inermi."

The only misleading item in the description is the phrase "spinis . . . patentibus." This suggests that the spines are "open," as are the claws of some of the *Lambis* species discussed above, that is, patulous or having the edges of the processes not yet approximating. This is not true of the adult *gigas*. The quoted phrase undoubtedly means that the spines are merely hollow, although they appear solid from the outside. The phrase is still equivocal, however, as only in the immature shell are they hollow in the true sense of the word, and this may be seen only from the inside. In mature shells they become filled with shell material and their openings into the aperture partially covered with enamel, so that, viewed from the inner face, the first two spines show as mere dents. The difference in the age of the shell between the formation of the outer surface of the spine and the deposition of the filler material is made evident when the tip of the spine is broken off. The filler is then seen inside the broken end, covered with a thin crust which is the original thin-walled spine.

In the copy of the twelfth edition owned by Linnaeus' son the word "vividissimus" in the subdescription is improved by the manuscript addition of the word "carneus."

The synonymy, in the twelfth edition at least, is extremely poor. In the tenth edition two correct figures were cited. The Buonanni figure (pl. 321) was probably based on an immature *gigas*. The other (Gualtieri, pl. 33, fig. A) is a good picture of the adult shell. Several figures were added in the twelfth: Another Buonanni figure (pl. 307) was evidently based on a specimen of *S. raninus* Gmelin, 1791 (*S. bituberculatus* Lamarck, 1822). The Rondelet figure (p. 76) shows an immature and broken *Strombus* which might be any one of a number of species. The three Lister figures cited (pl. 860, figs. 17-18, and pl. 882, fig. 4) were stricken out by Linnaeus in his copy of the twelfth edition, and Lister's plate 863 was substituted. Plate 860, figure

17, the only figure on that plate, was identified in the Index to the Dillwyn edition (1823) as *S. fasciatus* (Gmelin). Hanley (1855, p. 272) called it *S. bubonius* (Lamarck), a synonym of *fasciatus*. Figure 18 (pl. 861, not 860) is identified in the Index as *S. lentiginosus* Linné which is probably correct. Plate 882, figure 4, is called in the Index "A young shell of *Strombus truncatus*," which also is a reasonable opinion. Plate 863, Linnaeus' substituted plate, shows a single figure which, while badly drawn, assuredly shows the adult *gigas*. The figure from Gesner (1558, "p. 340")¹ is a copy of the figure of Rondelet. The Aldrovandi figure (no page, plate, or figure given) is found on page 334 of the 1606 work. It is called *Murex marmoreus* and also seems to have been copied from Rondelet's figure. The references to Olearius (pl. 32, fig. 5) and Colonna (pl. 60, fig. 5) were not seen, but Hanley (*loc. cit.*) reported the latter to be *S. fasciatus* and felt that it was an error of transcription for figure 4 which showed *S. goliath* Sowerby, 1842, a somewhat more accurate approximation.

For Linnaeus' variety " β " of *gigas* a further Gualtieri figure (pl. 54, fig. M) was cited. This figure shows an immature *gigas* and is discussed above under *S. lucifer*, the preceding species. Linnaeus thus cited it for the young shell, apparently oblivious to his diagnosis of *lucifer*, which is itself the young *gigas*.

In spite of the discordant synonymy, Linnaeus' followers had no difficulty in identifying the species, which is at least partial proof of the clarity of the description, although the specific name itself was certainly weighty evidence. The first post-Linnaean description was that of Davila (1767), who described it as "the huge winged shell of America" and spoke of the coronation of spines and the rose-colored aperture. The first post-Linnaean figure, as well as the first post-Linnaean use of the name *gigas* that I have been able to find, is in Martini (1769-1777, vol. 3, p. 117, pl. 80, fig. 824), a very fair and unmistakable representation of the species, for which Martini referred to the *gigas* of the "Systema."

¹ Linnaeus cited this figure as "p. 340," but that page contains only text. The figure is on page 690.

The only synonyms of *gigas* are two names recently given to forms that have no specific or subspecific value; a malformed specimen with flattened spines was named *S. gigas horridus* by Maxwell Smith (1940, p. 131, sp. 1629a), and *S. gigas canaliculatus* Burry (1949, p. 106) has a deeply channeled suture.

In 1945 several specimens of a *Strombus* very close to *gigas* were collected by Verrill in shallow water in the north end of Lake Worth, Florida, and were described and figured in the following year by McGinty (1946) as a subspecies to which he gave the name *S. gigas verrilli*. It is distinguished from the typical *gigas* principally by having nine to 11 spines on the body whorl instead of five to seven, but McGinty noted several other points of difference, in both anatomical and shell characters. Since then a considerable series has been collected, all in the type locality and in a very restricted area. Conchologists are not unanimous in giving subspecific rank to this shell, but to the present writer the marked and constant differences in the shell and animal from those of *gigas* seem to merit its acceptance as a good subspecies.

Another name must be considered in connection with the present species. *Strombus samba* Clench, 1937 (p. 18, pl. 1, fig. 1), was described by Clench from specimens collected at West End, Grand Bahama Island. It has not been universally accepted as a good species and has been variously called a form of *gigas*, a diseased or aberrant *gigas*, or a hybrid of *gigas* and *S. costatus* Gmelin, 1791. It is closely related to *gigas*, however, although it possesses characters approximating *S. costatus*. Clench and Abbott (1941, pp. 11-12, pl. 8, dorsal and ventral aspects) distinguished it from *gigas* "by its smaller size, much thickened and shorter lip, and the presence of a great deal of aluminum-like glaze. The soft parts, particularly the portion extruded while crawling, are nearly entirely black, while the color of *S. gigas* is orange red." They also said (pp. 10-11): "Parietal wall and outer lip brownish yellow, merging into deep pink within the aperture." The species has a less deeply developed stromboid notch than *gigas*, and its spines are, in general, smaller than in that species. The shell has since been found in fair

numbers in other localities in the Bahamas, and recently in Lake Worth, Florida. Verrill (1948, pp. 1-2) reported his examination of a large series of *samba* and put the case for its specific separability from *gigas* very strongly, as did Clench and Abbott. The present writer's collection contains several specimens of *samba* from Andros Island and New Providence Island in the Bahamas which he has no hesitation in treating as a good species. *Strombus samba* has always been known to the natives of the Bahamas, although, strangely enough, had never come to the attention of conchologists, or, at least, its divergence from *gigas* had never been appreciated by conchologists, until Clench's specimens were found at West End. Although the animal of *gigas* is a staple native food in Florida and the West Indies, the Bahamians, at least, do not eat *samba*, and I have been told by many of them that it is inedible and even poisonous. I have not been able to substantiate this fact. The name "Samba," by which it is known in the Bahamian vernacular, means "half-breed," as the natives apparently believe that it is a hybrid of *gigas* and some other shell. It is probable that the theory that it is a diseased *gigas* originated in the minds of people who were familiar with the native belief that it was inedible or poisonous.

A further note on *samba* is added. The finding of immature specimens and adult specimens in good condition is seldom reported. It is possible that the immature shells resemble the young *gigas* too closely to have been noticed even by experienced collectors. In the case of adult individuals, most specimens found are gerontic shells, much thickened and heavily incrustated and with broken and frayed lips. It has been very plausibly suggested that this is because the native fishermen do not disturb them when found, and they are therefore left to grow massive and to show all the other signs of senility.

In addition to the Martini figure cited above, *Strombus gigas* is figured by Reeve (1843-1878, vol. 6, *Strombus*, pl. 2, sp. 2) and by Sowerby (1847-1887, vol. 1, *Strombus*, pl. 10, fig. 117).

The Linnaean collection in London contains two specimens. One is an adult, properly marked with the "Systema" number

of *gigas*. This is stored separately, as it is too large to be placed in the cabinets. The other is a half-grown shell, similarly marked. This is the specimen mentioned in the discussion of *S. lucifer* (p. 268, above). It is in the growth stage represented by another Martini figure (*tom. cit.*, pl. 90, fig. 881).

The species was not described in the "Museum Ulricae."

Strombus latissimus

1758, *Systema naturae*, ed. 10, p. 745, no. 436.

1767, *Systema naturae*, ed. 12, p. 1211, no. 505.

LOCALITY: "In O. Asiae" (1758, 1767).

"S. testa labro rotundato maximo, ventre inermi, spira subnodosa."

Strombus latissimus and *S. gigas* represent the two species among the Linnaean strombs in which the outer lip attains the greatest degree of expansion, as well as being the two largest members of the genus known to Linnaeus. The descriptions of both very properly contain the phrase "labro rotundato maximo," but the two species are definitely distinguished by the description of the coronation of spines in *gigas* and the antithetical phrase "ventre inermi" for *latissimus*. The difference in the sculpture of the spire in the two shells is also noted. The description of *latissimus* was the same in the tenth and twelfth editions of the "Systema" and led to its immediate identification.

The figures in the synonymy are characteristic and accurate. Both the Rumphius figure (pl. 36, fig. L) and those from Seba (pl. 63, figs. 1-2) were unmistakably based on *latissimus*.

Linnaeus omitted to mention two of the most distinctive and unusual features of the shell. The expanded lip rises higher above the apex of the spire than the lip of any other stromb, is adherent to it, and thickens progressively from its posterior to its anterior end. In gerontic individuals the anterior end of the lip may be as much as an inch in thickness. The stromboid notch is more deeply developed than in *gigas* and is bounded anteriorly by a thickened and protruding lobe. This is in marked contrast to the thinness of the lip edge in *gigas* which is so fragile that it is rare to find a specimen that is not frayed or broken. It may have been that Linnaeus was describing a subadult specimen. We know

that he did not own a specimen of *latissimus*, as the name does not appear on his lists of owned species, and it is therefore probable that he used a borrowed specimen or took his description from the pre-Linnaean iconographies or from one of his contemporaries. In the description in the "Museum Ulricae" it seems evident that he had a subadult shell before him, as that description contains the phrase "Labium . . . antice [*sic*] attingens medium spirae."

Gmelin (1791, p. 3516) added varieties " α " and " β ." The first is supported by a Martini figure (1769-1777, vol. 3, pl. 89, fig. 874) which is a good figure of the subadult *latissimus*, and the second by two other Martini figures (*tom. cit.*, pl. 89, figs. 875-876) which can be identified only as the juvenile shell of a *Strombus* species. They may represent an attempt to show *latissimus* in a younger stage than the shell shown in figure 874. Martini called these two figures "Alata tenuis flammis rufis undatis." Figure 874 was, however, cited by Lamarck for *latissimus*, as well as by Deshayes and Milne-Edwards, although Dillwyn (1817, p. 668) limited it to the "Junior" shell.

Schumacher (1817, p. 221) placed the species in the genus *Pterocera* Lamarck, 1799, disregarding Lamarck's explicit description of that genus, and changed the specific name to *alata* (*non S. alatus* Gmelin).

Dillwyn (*loc. cit.*) furnished a good description and a fairly accurate synonymy, but committed two errors. He synonymized the species with *S. latus* Gmelin (1791, p. 3520), although with a query,¹ and with *S. goliath* Sowerby,² 1842, which is a quite distinct species.

¹ *Strombus latus* Gmelin has had a confused nomenclatorial history. Although somewhat similar to *latissimus* Linné in a few of its characters, its lip is much less expanded, its upper projection reaching the middle whorls of the spire only in fully matured specimens, and the dorsum of its body whorl is provided with two or three prominent spines, in contrast to the almost unsculptured dorsum of *latissimus*.

Lamarck (1822, vol. 7, p. 203) changed its name to *dilatatus* for no apparent reason, a change that was later criticized by Deshayes and Milne-Edwards not only because *latus* Gmelin was earlier, but also because *dilatatus* was a homonym of *S. dilatatus* Swainson, an entirely distinct species. On the same page Lamarck described a *S. bubonius*, which he referred to *S. fasciatus* Gmelin (1791, p. 3510) and to a pair of figures from

Lamarck (1822, vol. 7, p. 200) purified Gmelin's synonymy to some extent, but fell into the same error as did Dillwyn by citing *Strombus goliath*, as of Chemnitz, in his own synonymy. Deshayes and Milne-Edwards

Martini (1769-1777, vol. 3, pl. 82, figs. 833-834), which Gmelin cited for his principal variety of *fasciatus*. Lamarck described *bubonius* as "tuberculata et nodulifera," and it seems to be agreed that it was merely a useless second name for *dilatatus* (*latus* Gmelin). Reeve (1843-1878, vol. 6, *Strombus*, pl. 12, sp. 27) treated it as a variety of *dilatatus*. Lamarck's identification of *bubonius* with *fasciatus* Gmelin is undoubtedly correct if we restrict it to Gmelin's principal variety. In Küster's *Strombus* article in the "Neue Ausgabe" of the "Conchylien-Cabinet" of Martini and Chemnitz [1845 (1837-1907), vol. 4, pt. 1] plate 82 of Martini, containing figures of *latissimus* and *bubonius*, is reproduced, and the two are listed correctly as distinct species. However, Küster lists *S. latus* Gmelin as a good species distinct from *bubonius*, whereas I believe them identical. In my opinion, *S. fasciatus* Gmelin, principal variety, *S. latus* Gmelin, *S. dilatatus* Lamarck, and *S. bubonius* Lamarck are one and the same species. Tryon (1879-1888, vol. 7, p. 108) tentatively suggests another synonym. Under *Strombus costatus* Gmelin he said: "Better known under the subsequently published name of *S. accipitrinus* Lamarck. *S. inermis* Swainson is merely a state of the species with less developed spines. *S. latus* Gmelin (= *dilatatus* Lam., not Swains.) is probably the same form." I wholly disagree with the queried identification of *latus* with *costatus* Gmelin.

* The name *Strombus Goliath* was first used by Chemnitz in 1795 (1780-1795, vol. 11, p. 147), who referred it to only one of the same Lister figures (pl. 862, fig. 18a) used by Gmelin for *latissimus*. Chemnitz' description contains one paragraph which has details applying to a fully matured *latissimus*: "This stromb has a very heavy and thick shell. It is white within and without, lacking any further color pattern. Its very narrow and contracted aperture resembles a long quadrilateral." Chemnitz' figure is obscure. It is not *latissimus*, as, although it shows a mature shell, the expanded lip is not adherent to the spire except at the last whorl. Sowerby's *goliath* (1847-1887, vol. 1, p. 35, pl. 10, fig. 118) is larger than *latissimus*; is said to have a coronation of coarse nodes at the shoulder, which descend as plications over the upper third of the whorl; has a shallower stromboid notch; and the color pattern of wavy, brown, spiral lines on the upper part of the whorl is unlike the longitudinal color pattern of the young *latissimus* or the bleached white of the dorsal area of the adult *latissimus*. Clench and Abbott (1941, p. 14) say of *goliath*: "Its exact locality is unknown. On various occasions it has been reported from the West Indies and the west coast of South America. We suspect that the species may be eventually found along the northern coast of South America." It is a rare shell. The American Museum of Natural History has a single specimen. The species is figured in Reeve (1843-1878, vol. 6, *Strombus*, pl. 1, sp. 1), the figure being based on a small specimen. Clench and Abbott's figure (1941, p. 14, fig. 10) was a copy of that of Reeve.

(1835-1845, vol. 9, p. 688) copied Lamarck's synonymy in full, but in a footnote they recognized Lamarck's error as to *goliath* and accepted it as a good species.

The only synonym of *latissimus* is *Pterocera alata* Schumacher, 1817, although *Strombus tricornis* Blainville, 1825, not Lamarck, 1822, has often been cited as being identical. This last is a very doubtful species.

As Linnaeus did not own a specimen of *latissimus*, a young, undocumented example in the Linnaean collection in London must be regarded with suspicion as having been introduced by another hand. The description in the "Museum Ulricae" conforms generally to that in the "Systema" and adds the confirmatory phrases "Testa laeviuscula" and "Color flavus, interdum albo nebulosus." The sentence as to the height of the upper end of the lip as compared with the height of the spire is referred to above as indicating that the specimen examined by Linnaeus in the Queen's collection was subadult. The shell now labeled *latissimus* in the Uppsala collection is of that growth stage.

The first figures of the species (Martini, 1769-1777, vol. 3, pl. 82, fig. 832, and pl. 83, fig. 835) are characteristic. It is figured by Reeve (1843-1878, vol. 6, *Strombus*, pl. 4, sp. 4), by Kiener (1834-1850, vol. 4, *Strombus*, pl. 4, 2 figs.), and by Duclos (1844-1845, vol. 7, pl. 13, figs. 5-6).

Strombus epidromis

1758, *Systema naturae*, ed. 10, p. 745, no. 436.

1767, *Systema naturae*, ed. 12, p. 1211, no. 506.

LOCALITY: "In O. Asiae" (1758, 1767).

"S. testa labro rotundato brevi, ventre laevi, spira subnodosa."

This is a very unsatisfactory description and gives anything but a complete or even correct picture of the shell that has become the *S. epidromis* of authors. Many of the important diagnostic details of the species are omitted, such as the milky white color of the columella and aperture, the basal striations, the thickened and everted lip, and the varices, in varying numbers, seen on the upper whorls of the spire. Moreover, it is incorrect in two particulars. The spire, with the exception of its last whorl, is not "subnodosa," but is longitudinally ribbed, the ribs being crossed by fine transverse lines.

The last whorl is markedly nodose in most specimens, although there is great variation in the strength of the nodes. Also the body whorl is not "laevi," but has a series of nodes of varying strength, which are strongest near the outer lip and become obsolete as they approach the columella. When strong nodes are present, some of them are continued into weak ribs which extend a short distance down the whorl. The lip is produced posteriorly into a pointed wing which is adherent to the penultimate whorl of the spire when viewed from the dorsal face of the shell and the columellar callus is also produced and is adherent to the spire at this point, providing a curving and almost closed posterior canal. The stromboid notch is moderately well developed.

Two of the three figures cited in the synonymy are correct. Rumphius' figure (pl. 36, fig. M) and the figure from Seba (pl. 62, fig. 21) clearly show the *epidromis* of all authors. The Borellier work was not seen, but Hanley reported that the figure (pl. 1727, error for pl. 1323, fig. 2) shows *S. gibberulus* Linné, a shell of which the lip does not conform to the "rotundato" of Linnaeus' description. Linnaeus added a good figure of *epidromis* from Lister (pl. 853, fig. 10) in his manuscript revision of the twelfth edition.

This is another of the cases, so common in Linnaeus' *Strombus*, in which a correct synonymy, or a majority of correct figures in a synonymy, must be relied on to supplement a too short or too deceptive description. While I deplore Hanley's "rule-of-thumb" that a preponderance of figures of one species should have conclusive weight in the determination of identity, it must have been true that the early followers of Linnaeus used this rule in many cases. In this instance *epidromis* Linné was identified as early as 1777, by Martini (1769-1777, vol. 3, p. 111, pl. 79, fig. 821), who, while he called it "*Alata epidromis expansa*," referred it to the *epidromis* of the "Systema" and supplied a figure which, while crudely drawn, is unmistakably *epidromis*. Of course, in many of these cases of inadequate descriptions, including the present, the shell was already well known to conchologists even by the Linnaean name. Rumphius called it "*Epidromis longa*," Klein, "*Epidromis canadensis*," and Lesser, "*Epidromis altera*."¹

Hanley (1855, p. 273) concluded that the

description of *epidromis* in the "Museum Ulricae" covered another species, although he did not name it. The details on which he based his conclusion were the phrases "Color testaceus, fasciis linearibus albis articulatis" and "utroque labro substriato." The phrases relating to the color might conceivably, however, be applied to the color pattern of many fresh specimens of the *epidromis* of authors, and certain other items in the description: "Spira ut et dorsum carinato-subnodosa," "Labrum exterius versus medium magis gibbum, versus posteriora [*sic*] sinu emarginatum," and "interius longitudinaliter adnatum," very graphically fill the gaps in the "Systema" description, as they all apply to *epidromis*. Hanley's second objection, however, the phrase "utroque labro substriato," does not describe *epidromis*, and the feature described has not been used in later descriptions of the species.

I do not know what species Linnaeus had before him in the Queen's collection that could have suggested the language as to the striation of the lip in both the aperture and outside, but its use casts some doubt on the whole diagnosis, although the specimens now labeled *epidromis* in the Uppsala collection are the typical *epidromis* of authors. I have already called attention in these papers to the fact that the descriptions in the "Museum Ulricae" raise questions that cannot be answered, that the existing labels, not having been written by Linnaeus, have little authority, and, finally, that we are certain that removals and mixtures have occurred since the collection was examined by Linnaeus in the Queen's residence at Drottningholm. The description of *epidromis* raises some of these questions anew.

The specimen marked for *epidromis* in the Linnaean collection in London is the *epidromis* of all authors and may therefore be accepted as the type specimen.²

¹ Chemnitz' "*Strombus epidromis minima*" (1780-1795, vol. 10, p. 214, pl. 156, figs. 1491-1492) is not a young *epidromis* Linné but *S. minimus* of the "*Mantissa*" (see p. 298, below).

² I again call attention to the fact that I use the word "marked," as Hanley did, for a specimen bearing the "Systema" name or number, in Linnaeus' handwriting, on the shell itself or on the tray in which it was contained at the time Hanley made the first critical examination of the whole collection in the years immediately preceding 1855. When only the tray was so marked, the

Strombus epidromis is figured by Reeve (1843–1878, vol. 6, *Strombus*, pl. 19, sp. 54) and in Kiener (1834–1850, vol. 4, pl. 26, fig. 1).

Strombus canarium

1758, *Systema naturae*, ed. 10, p. 745, no. 438.

1767, *Systema naturae*, ed. 12, p. 1211, no. 507.

LOCALITY: "In O. Asiae" (1758, 1767).

"S. testa subcordata labro rotundato brevi retuso, spiraque laevi. . . . Testa admodum gibba et quasi pinguis apparet."

The description in the tenth edition did not contain the words "subcordata" or "retuso," and the entire subdescription was also added in the twelfth. As thus improved, it is entirely adequate to define the *S. canarium* of authors, although it omits many of the salient features of the shell. There is no mention of the pure white aperture and columella or of the marked thickening and inversion of the upper part of the lip or its prominent wing, except as the latter feature might be suggested by the use of the word "subcordata." The prolongation of the posterior tip of the lip and its adherence to the spire are not noted. The aluminum-like glaze on the parietal wall and the lip, which is seen in fresh specimens, is not referred to, nor, indeed, are any details as to the color.¹

One phrase of the description is misleading. The spire is not smooth. The last two whorls show a single and almost unnoticeable depressed line just below the suture, and the upper whorls are finely decussate and occasionally bear one or more white varices. This sculpture is hardly visible without the aid of a lens and is not shown in the photograph of the species either on the microfilm of the Linnaean collection in London or on that of the Uppsala collection. In Linnaeus' manuscript notes in his copy of the twelfth edition he substituted "saginata" for "pinguis," involving little change in meaning, as "pin-

guis" means "fat" and "saginata" means "fattened" or "tumid."

The synonymy is almost wholly correct. Two of the Seba figures (pl. 62, figs. 24–25) seem closer to the form, or species, *S. isabella* Lamarck (1822, vol. 7, p. 207).² The cited figures from Buonanni (pl. 146), Petiver (pl. 98, fig. 11), Rumphius (pl. 36, fig. N), Gualtieri (pl. 32, fig. N), Argenville (1742, pl. 17, fig. Q), Klein (pl. 4, fig. 73), and Seba (pl. 62, figs. 28–29) are all sufficiently clear to be accepted for *canarium*. Gualtieri's other figure cited (pl. 32, fig. L) was considered by Hanley (1855, p. 273) to represent *isabella*, but to the present writer it more nearly resembles *epidromis* Linné. It was, in fact, cited for that species by Linnaeus in both the tenth edition of the "Systema" and in the "Museum Ulricae," although it was omitted from the synonymy of *epidromis* in the twelfth edition. Linnaeus added a further good figure of *canarium* (Lister, pl. 853, fig. 9) by a manuscript note in his copy of the "revised twelfth edition."

In spite of its distinctive appearance and the facility with which the species was identified by the early post-Linnaean writers, it has acquired several synonyms. It is the *Alata perdix* Humphrey of the "Museum Calonnianum," 1797; *Strombus vanikorensis* Quoy and Gaimard, 1834, and *S. gibbus* Tapparani-Canefri, 1874. The specific name *gibbus* may have been derived from the *Epidromis gibba* of Seba or the *E. gibbosa* of Petiver.

The species is figured by Reeve (1843–1878, vol. 6, *Strombus*, pl. 18, sp. 46a, b), by Kiener (1834–1850, vol. 4, pl. 29, figs. 1, a1), and by Sowerby (1847–1887, vol. 1, pl. 8, figs. 69–70).

The type specimen of *canarium*, marked by

² *Strombus isabella* is distinguished from *canarium* by its more attenuated shape, by the convexity of the whorls of its higher spire, and by the absence of the sinuous horizontal brown lines on the body whorl of *canarium*. Lamarck listed it as a good species. Dillwyn (1817, p. 671) described a variety of *canarium* "with the spire more produced and the whorls rounded" which was undoubtedly *isabella*, based on the figures he cited for it. Deshayes (1830, 1832, vol. 3, p. 990) treated it as a variety of *canarium*, but later Deshayes and Milne-Edwards (1835–1845, vol. 9, p. 700) restored it to its status as a good species. Tryon (1879–1888, vol. 7, p. 110) reverted to the theory that it was a form of *canarium*. I would be unwilling to unite it to that shell because of the constant divergence of its shape and color pattern.

specimen is acceptable as the type only if it is the sole specimen in the collection that conforms to the description, and, further, if there is no other evidence suggesting a mixture of specimens, and the species appeared on one of Linnaeus' "lists."

¹ The aluminum-like glaze may have been referred to by Argenville (1742, p. 293) when he said: "... its lip . . . forms a sort of wing whose color approaches that of lead."

Linnaeus, is found in the Linnaean collection in London.

The description in the "Museum Ulricae" harmonizes with that in the "Systema" and adds several confirmatory details. The spire is described as "Spira laevi, vix striata nisi apice," a somewhat casual way of calling attention to the sculpture noted above. The phrases "Labium crassum, antice [*sic*] gibbum, adnatum unico anfractus spirae" and "faux laevis, alba" fill in gaps left by Linnaeus in the "Systema" description. The specimens now labeled for *canarium* in the Uppsala collection are the *S. canarium* of authors.

Strombus vittatus

1758, *Systema naturae*, ed. 10, p. 745, no. 439.

1767, *Systema naturae*, ed. 12, p. 1211, no. 508.

LOCALITY: "In O. Asiae" (1758, 1767).

"S. testa labro rotundato brevi, ventre laevi, spirae elongatae anfractibus sutura elevata distinctis . . . Confer. Gvalt. test. t. 33. f. B. Argenv. conch. t. 13. f. C. An sola varietas? Variat testa laevi et subplicata; semper elongata."

Except for the fact that *vittatus* is an extremely variable species in respect to the height of the spire and the number of whorls it produces, the existence of spiral sculpture, the prominence and extent of the longitudinal sculpture, and the size of the body whorl in comparison with the lower whorls of the spire, the above is an adequate description of *vittatus*, as it gives details common to all forms of the species. It is, however, inadequate for one to determine just what form Linnaeus had before him, as the only hint of variation in it is the phrase "Variat testa laevi et subplicata" in the subdescription and "ventre laevi" in the main description. The most important diagnostic character of the species is illustrated by the phrase "anfractibus sutura elevata distinctis," which at once distinguishes the species from any other of the Linnaean strombs. This feature was well described by Dillwyn (1817, p. 671) as "the spire produced with an elevated belt at the sutures."

The synonymy is only partly correct. Of the Seba figures (pl. 62, figs. 18–20; pl. 79, fig. 1), those on plate 62 are characteristic. There are no numbers on plate 79, but Linnaeus probably meant the upper left-hand figure which, while it surely was not based on

a specimen of *vittatus*, shows, a very high spire. I am unable to identify it. The figure from Argenville (1742, pl. 12, fig. F) is a poor drawing, but shows some of the essential features of *vittatus*, the subsutural raised band and the white bands on the body whorl, and may safely be used for the high-spined form of *vittatus* which was latter called *S. turritus* by Lamarck (1822). The Petiver figure (pl. 98, fig. 12) is only fairly characteristic but may be accepted as *vittatus*. The figure from Rumphius (pl. 36, fig. O), which Rumphius called "Epidromis," is satisfactory.

The two references in the subdescription, which Linnaeus suggested might be compared with *vittatus*, were stricken out by Linnaeus himself in his copy of the twelfth edition, and were therefore not designed to appear in his proposed "revised twelfth edition." The first (Gualtieri, pl. 33, fig. B) is, to the present writer, unidentifiable. The second, from Argenville (1742, pl. 13, fig. C), resembles *vittatus* only in having four interrupted white bands on the body whorl. It also bears a superficial resemblance to *succinctus* Linné, and was, in fact, also cited for that species (see p. 279, below).

Martini (1769–1777, vol. 3, p. 110, pl. 78, figs. 819–820) showed reasonably good figures of the "typical" or shorter-spined form of the shell, and on the same plate (figs. 822–823) the form with the produced spire. The latter pair of figures shows the raised subsutural band very clearly, although somewhat exaggerated. Martini referred all four figures to *S. vittatus* Linné. Chemnitz (1780–1795, vol. 10, p. 208, p. 155, figs. 1481–1482) listed a "*Strombus vittatus angustior*," which he referred to the *vittatus* of the "Systema" in his text. The figures cited are clearly one of the high-spined forms, with the body whorl shortened and showing longitudinal sculpture on both body whorl and spire. On page 217 of the same volume Chemnitz described a "*Strombus vittatus maris rubri*," for which he supplied no references, and did not mention Linnaeus' *vittatus* even in the text. He located the species in the Red Sea. His figure (pl. 157, fig. 1496) is extremely inconclusive. The spire is lower than in any specimen of this variable species seen by the present writer and is heavily longitudinally ribbed on all whorls. Otherwise the figure resembles the

shorter and more tumid form of *S. succinctus* Linné and was probably based on the form *robustus* Sowerby, 1874 (see *S. succinctus*, p. 279, below). The Red Sea locality, however, possibly repels this identification, as Sowerby reported *robustus* from Hong Kong.

In volume 11 Chemnitz (p. 142, pl. 195A, figs. 1870–1871) described and figured a *Strombus sulcatus*. This has often been tied, at least tentatively, to *S. vittatus* Linné. Chemnitz himself (*loc. cit.*) said that anyone who might take it, at first glance, for a variation (Abänderung) of *S. vittatus* would be wrong. He located it in Chinese waters. It is a puzzling figure. Its body whorl is smooth except for basal striations. It lacks the bluntly pointed extension of the lip of *vittatus*, and the subsutural raised band of that shell is replaced by a rather deeply canaliculate suture. The spire is markedly terraced and spirally striate. Dillwyn (1817, p. 672) listed it as a good species, but I suspect that he was a mere copyist and had not seen the shell. He referred to a figure from Lister (pl. 852, fig. 8) which Chemnitz had already mentioned in his comments on *sulcatus*. Chemnitz had said that he could find no figure of the species in the conchological works at his disposal and added that if one referred to the Lister figure he would find something resembling *sulcatus*, but which was unquestionably *vittatus* Linné.¹

Lamarck (1822, vol. 7, p. 207) did not mention *sulcatus* in connection with *vittatus*, but cited for that shell the Lister figure discussed by Chemnitz and cited by Dillwyn for *sulcatus*. Deshayes and Milne-Edwards (1835–1845, vol. 9, p. 701) also cited the Lister figure for *vittatus*. I find no reference to *sulcatus* in the later literature except in Tryon (1879–1888, vol. 7, p. 44) who decided that it was merely a malformed specimen of *vittatus*. It has a strong resemblance to *vittatus* in some of its features and is not at all

referable to any other species, and for this reason I am almost persuaded to agree with Tryon that Chemnitz' specimen was a monstrosity of *vittatus*, although it is probably safer, from a practical point of view, to treat it as a *species dubia*.

Dillwyn (*loc. cit.*) first separated the high- and low-spired forms of *vittatus* as varieties, and Lamarck (1822, vol. 7, p. 212) was the first to treat the former as a good species under his new name *S. turritus*. He described it as being "much more turriculate than the *Strombus vittatus* and only the lower part of the whorls is striate." This description is too broad and must have been based on a few specimens only. Even the high-spired forms show variation in the sculpture, the lower part of the whorls of the spire in some individuals being plicate, in others partially plicate, and in others smooth. Chemnitz' figures 1481 and 1482, which Lamarck cited for his *turritus*, show the entire area of the whorls of the spire longitudinally plicate, which somewhat weakens Lamarck's diagnosis.²

In the considerable series of specimens labeled *vittatus* and *turritus* examined by the present writer there were found, at the two extremes of the range of variation, specimens of the low-spired and high-spired shells that might well have been taken for distinct species. But these extremes were so well connected by intermediate forms showing various sizes of body whorl, height of spire, and sculpture that it was impossible to find any appreciable gap, or a line of cleavage, sufficiently marked to justify the allocation of two specific names. I would therefore treat the name *turritus*, if, indeed, it should be used at all, as a varietal name applied to an extreme form of this extremely variable species. The name is, however, occasionally used today and is commonly found in unrevised collections. Tryon (*loc. cit.*) said of it: "*S. turritus* Lamarck is a slender form with the spire more dominant and the lip not so much expanded."

¹ The Lister figure, although cited by Chemnitz only by the plate number, 852, was properly referred to by all later writers as plate 852, figure 8. It is strange that Chemnitz should ever have referred to it. It has not the slightest resemblance to his figure of *sulcatus*, and only the vaguest likeness to *vittatus*, as it shows little expansion of the outer lip, and no longitudinal sculpture whatever. It is, however, spoken of in Dillwyn's Index to the third edition of Lister (1823, p. 38) as follows: "Is *Strombus sulcatus*, and has been generally and erroneously quoted for *Strombus vittatus*."

² Deshayes and Milne-Edwards (1835–1845, vol. 9, p. 709), the editors of the second edition of Lamarck's final work, disagreed with the latter's conception of *turritus*, saying: "An examination of this species has convinced us that it should be suppressed and be united, as a variety, with the *Strombus vittatus* of Linné."

The species *Strombus vittatus*, in its various forms, is figured in Duclos (1844-1845, pl. 23, figs. 1-2), in Reeve (1843-1878, vol. 6, *Strombus*, pl. 17, sp. 44a, 44b), in Sowerby (1847-1887, vol. 1, pl. 6, figs. 27-31), and in Tryon (1879-1888, vol. 7, pl. 4, figs. 41-44).

A marked specimen of *S. vittatus* is present in the Linnaean collection in London, according to Hanley (1855, p. 273). There is, however, no photograph of such a specimen in the microfilm of the collection in the present writer's possession, and I am therefore unable to say which form of the species was seen by Hanley. Either Hanley was deceived or the specimen has been lost. Both alternatives, however, seem unlikely. It is even less likely that this particular specimen is present but was not photographed.

The description of *vittatus* in the "Museum Ulricae" provides many additional details and was apparently based on the form *turritus*, as is shown by the words "subplicata" as applied to the whole shell and "transversaliter striata" as applied to the spire. The two specimens now in the collection at Uppsala, labeled *vittatus*, are both of the larger form of the species with a smooth body whorl and less slender spire. As already noted in these papers, it is often impossible to reconcile the descriptions in the "Museum Ulricae" with the specimens now in Uppsala and labeled to conform to the specific name covered by the descriptions.

Strombus succinctus

1767, *Systema naturae*, ed. 12, p. 1212, no. 509.

LOCALITY: "In India" (1767).

"S. testa labro rotundato retuso, ventre laevi cingulis quatuor pallidis lineari-punctatis... Testa laevis, testacea, dorso subcarinato cincto lineis bigeminis albo-punctatis. Spirae anfractus striati carinula crenata. Labrum exterius intus striatum; interius adnatum, laeve, gibbum, antice substriatum."

This is a puzzling description. In the first place, one of the most noticeable features of the species is omitted—the long posterior extension of the outer lip, which rises as high as the top of the penultimate whorl of the spire, viewed dorsally, its left edge being free and the right edge, in most specimens, adherent. Below this process is a rounded pro-

tuberance of the lip. In general the contour of the lip recalls that feature in *S. canarium*, except that the upper extension is much longer than in *canarium*, and the lower much less produced and thinner. Certain details of the description are equivocally worded. "Ventre laevi," if it applies only to the apertural face of the shell, is correct, but the meaning Linnaeus gave to the word "venter" is uncertain. In some descriptions the context makes it clear that he referred to the apertural face. In others he seemed to mean the whole body whorl—the "belly" of the shell. In the present case the present writer is in doubt. The apertural face is certainly smooth. The dorsum is equally smooth, although it is provided with a decided hump near the suture, which in some individuals is so prominent that it becomes a blunt spine. I suggest that Linnaeus did not consider that the hump, the surface of which is itself smooth, was anything more than a swelling on the back of the shell. If I seem to be laboring this point, it is merely to suggest that caution should be used in interpreting the Linnaean descriptions in this respect. The subdescription uses the phrase "dorso subcarinato." It is assumed that this applies to the shoulder of the shell, as the hump could not be called a carina. If so, Linnaeus used a most inapt word. There is no keel or ridge around the shoulder of *succinctus* such as is seen in *S. marginatus* Linné. The shoulder is evenly rounded on the side towards the lip and only very obtusely and slightly angulate on the side towards the aperture. "Lineis bigeminis" is not understood. It may refer to the longitudinal color pattern, as in most specimens there are two or three pairs of vague longitudinal brown lines on the part of the shell nearest to the lip, but, if these are meant, the phrase "albo-punctatis" applied to these lines must refer to their interruption by the spiral white bands, and these latter had already been graphically described in the main description as "cingulis quatuor pallidis lineari-punctatis." The whole description of the color pattern is unsatisfactory, and the majority of the other details in the description are couched in badly chosen words. Moreover the word "bigeminis" is either one coined by Linnaeus to mean "twinning" and is pleonastic, or it means "dotted with pairs of

spots (*gemma*)," which does not describe any feature of the color pattern. The concluding phrase "antice substriatum" cannot refer to the faint incised lines at the base of the shell, as Linnaeus constantly and erroneously called this part of the shell "postice." If it does apply to the posterior end, it is inexact.

The synonymy consists, for the most part, of badly drawn figures, although they have been accepted by many writers as showing *succinctus*. One of the Seba figures (pl. 62, fig. 20), for instance, pictures a shell with a much higher spire than that of *succinctus*, although in other respects it is satisfactory. The figure from Argenville (1742, pl. 13, fig. C), when examined in connection with Argenville's text, is deceptive. It accurately shows the color pattern of *succinctus* but is a much more regularly ovate shell and does not show the posterior extension of the lip. It is a dorsal view. Argenville said of it: "The little Buccin C is odd because of its groups of tubercles; its lip is dentate." Neither of these details describes *succinctus*, although the figure has been several times cited for it.

In spite of the curious language of the description in the "Systema" and the unsatisfactory synonymy, we know that Linnaeus' shell was the *succinctus* of authors, as the holotype, marked in the handwriting of Linnaeus, is present in the collection in London, although it is difficult to understand how the early post-Linnaean writers, beginning with Martini in 1777, could have been so confident of its identification.

In the twelfth edition of the "Systema," where the name first appeared, it is printed as "ccinctus," the first two letters having been omitted through a printer's error. Either "succinctus" or "accinctus" could have been chosen by readers, as the two words have almost the same meaning ("girdled" or "girdled below"), and both apply to the bands of white encircling the body whorl. Martini (1769-1777, vol. 3, p. 105, pl. 79, figs. 815-816) chose *succinctus*, but Born (1780, p. 283, pl. 10, figs. 14-15) used *accinctus*, and this reading was accepted by Dillwyn (1817, p. 672), although he referred to the *S. succinctus* of Martini, Schröter, and Gmelin. The Martini figures are by far the best representations of the shell that appeared before the advent of photography. The Born

figures were correctly considered by Dillwyn to represent the young shell "with the outer lip not expanded." The matter of the name is settled for us by Linnaeus himself, as, by a manuscript note in his copy of the twelfth edition of the "Systema," he wrote "*succinctus*" in place of the original misprint, but the almost universal use of that name by his successors must have been purely a matter of choice, as his manuscript notes were never published, and we may assume that they were unavailable to conchological writers for many years. I refer, under *S. marginatus* (p. 262, above), to Dillwyn's possible confusion of mind as to the relation of that species to *succinctus* in the works of Schröter, Gmelin, and Chemnitz.

The relationship of two other shells to *succinctus* has been discussed by conchologists. The first is *Strombus septimus* Duclos (1844-1845, p. 7, pl. 15, fig. 11, pl. 26, fig. 2, pl. 30, figs. 9-10). The spire of that shell, based on the various descriptions read, is slightly more produced than in the typical *succinctus*, and the whorls of the spire are more angular and more nodulous. The body whorl is said by Tryon (1879-1888, vol. 7, pp. 116-117) to be "less distinctly or not at all humped on the back, lip more expanded at the shoulder." These distinctions are, in general, those disclosed by Duclos in his description and figures. In the considerable series seen by the present writer, labeled, respectively, *succinctus* and *septimus*, it was found that if the two names represent distinct species they were mingled in most of the lots examined. Many lots labeled *succinctus* contained specimens in which the hump on the back was obsolete or obsolescent and in which the whorls of the spire were markedly angulated and nodulose. The same confusion was seen in the lots labeled *septimus*, and under both labels there was some variation in the exertion of the spire. The individual specimens, however, showed such a significant intergradation of all these so-called distinguishing characters that I would hesitate to accord a separate specific identity to the name *septimus* Duclos.

The other shell of which the relationship to *succinctus* has been discussed is *S. robustus* Sowerby, [?1874]. This shell is somewhat more tumid than the "typical" *succinctus*. Only two

specimens were seen by the present writer. One showed the dorsal hump, which in the other was lacking. The whorls of the spire were neither angulate nor nodulous in either specimen. Based on Sowerby's description and figures ([?1874], p. 599, pl. 72, figs. 5, 5a), however, I would again hesitate to say that *robustus* was not conspecific with *succinctus*.

Crosse and Paul Fischer (1889, p. 287) treated *septimus* as a good species. Paul Fischer, however, later said (1891, p. 158) of *septimus*: "This form appears to be merely a variety of *succinctus* Linné," and Dautzenberg and Henri Fischer (1905b, p. 404) considered both *septimus* and *robustus* to be synonyms of the Linnaean species. Tryon (1879-1888, vol. 7, p. 117) did not mention *robustus* in connection with *succinctus* but treated *septimus* as a variety. I have seen no reference to the position of the two species since Dautzenberg and Henri Fischer, 1905.

Except for the two above names the species has no synonyms.

Strombus succinctus, in addition to the excellent Martini figures mentioned above, is figured by Reeve (1843-1878, vol. 6, *Strombus* pl. 17, sp. 43) and by Kiener (1834-1850, vol. 4, pl. 10, fig. 2).

The species was not described in the "Museum Ulricae."

Strombus spinosus

1758, *Systema naturae*, ed. 10, p. 715, no. 271 (in *Conus*).

1767, *Systema naturae*, ed. 12, p. 1212, no. 510 (in *Strombus*).

LOCALITY: Not given in either edition.

"S. testa labro attenuato integro subplicato coronato spinis argutis, spira aculeata . . . Statura Volutae vespertilionis sed basis minime emarginata, nec columella plicata. Lineolae purpurascens, parallelae, numerosae cingunt testam albidum, superne angulatam et spinis acutissimis coronatam. Mirum colores perennare in fossili testa?"

The description of this species, which was placed in the genus *Conus* in the tenth edition, was considerably amended in the twelfth, without, however, any important changes in meaning. The subdescription was changed very little. The word "validis" had been placed before "coronatam" in the tenth, and the tenth-edition "argutissimis" became

"acutissimis" in the twelfth, a questionable improvement. The final sentence as to the retained color of the fossil was added in the twelfth. The main description in the tenth, however, anticipated many of the details of the subdescription. There is no hint in the tenth edition that Linnaeus realized that he was dealing with a fossil shell, but in the twelfth the words covering the color reveal that he had learned the nature of the species.

There has never been any question as to the identity of this species, although its proper generic position has been the subject of dispute, particularly in recent years. Linnaeus himself moved it from *Conus* to *Strombus*, and hinted that it might possibly be a *Voluta* by comparing it with *V. vespertilio*, which it resembles in some gross characters. The description is completely adequate for one to identify it with the *Volutospina spinosa* of recent authors, a fossil that has a stratigraphic distribution from the Cretaceous (Turonian) to the Tertiary (Eocene).

The synonymy is poor. The Gualtieri figure (pl. 55, fig. E) shows the coronate spines of the shoulder, the spiral lines of color around the body whorl, and the aculeate spire, but not the other items of sculpture. It is a highly conventionalized drawing. The Argenville figure (1742, pl. 33, fig. 10) is represented by one and probably two of a series of four drawings all under the number 10. The two closest to *spinosus* are the first (an apertural view) and the fourth (a dorsal view). None shows any lines around the body whorl. They are badly drawn, but do not deserve the strictures of Burnett Smith (p. 281, below) to the effect that they show "four different species of four different genera." The Petiver figure (pl. 78, fig. 11) is the worst of the cited figures. It is a dorsal view showing the plications of the body whorl as flat-topped ribs, with the spiral lines seen only between the ribs, but the coronation of the shoulder is characteristic.

The species was identified as early as 1783 by Schröter [1783 (1783-1786), vol. 1, p. 443], who retained the name *Strombus spinosus* and gave a characteristic description. He recognized it as a fossil but hinted that it might be found Recent as well, as he said: "Linnaeus had this shell only in a fossil state, and wondered that its color was so well preserved." Gmelin (1791, p. 3518) also had

the same suspicion, expressed in his phrase "hactenus modo fossilis inventus."

All authors retained the species in *Strombus* until 1802, when Lamarck (1802, p. 477) transferred it to *Voluta* as *Voluta spinosa*. He described it as an abundant fossil at Grignon (Paris Basin Eocene). It is probable that he abandoned *Strombus* as its genus, because it lacks the stromboid notch. This is suggested by Deshayes and Milne-Edwards (1835-1845, vol. 9, p. 721). In their discussion of another Grignon fossil, *Strombus canalis* Lamarck, they added the following footnote: "The *Strombus spinosus* of Linné lacks the sinus of the strombs, and belongs in the genus *Voluta*, as it possesses a columella which is plicated anteriorly."

Paul Fischer (1880-1887, p. 607) gave the name *Eopsephaea* to the group to which *spinus* belongs, with *Voluta muricina* Lamarck, 1802, as type species. This is a generic name that was entirely abortive and has been little used.

In 1831 Swainson (1829-1833, pl. 53 and pertinent text) erected the genus *Volutilithes* for the fossil group of *spinus*, although he did not mention *spinus* in the work mentioned, making *Voluta muricina* Lamarck the type species. In his later "Treatise on malacology" (1840, p. 318), which published a second list of species of *Volutilithes*, *spinus* was his first species. *Volutilithes* is the generic name for the group that has had the longest life, having persisted in general use until 1906.

In the latter year Dall (1906b, p. 143) called attention to the fact that Swainson's type species of *Volutilithes* was *V. muricina*, by original designation, and not *V. spinosa* as writers of that day had apparently believed, and also suggested that *Plejona* Röding, 1798, should supplant the Swainson name. This pronouncement provoked a serious discussion. A few months later R. B. Newton (June, 1906, p. 103) referred to Dall's remark and suggested *Volutospina* as a new name for this group, because the change in type rendered a considerable number of species, theretofore in *Volutilithes*, without a generic name. *Volutospina spinosa* (Linné) was designated as the type species of the new genus. The name is now generally accepted by conchologists as the genus to contain the present species.

In the following year, in "A review of the

American Volutidae," Dall disagreed with Newton and argued (1907a, p. 353) that *Plejona* should be used, as *Volutospina* was unnecessary. He said: "I shall elsewhere discuss the propriety of conserving the name *Plejona*, which I revived (by the process of elimination) in the Nautilus for April, 1906, p. 143, for the type of *Volutilithes spinosa* Lamarck. Mr. R. B. Newton, seeing merely the brief announcement without discussion, has objected on grounds which, it would seem, further consideration will show to be insufficient. He therefore has proposed for this group the name *Volutospina*. I quite agree that this would be an agreeable way to settle a disagreeable question, but unfortunately, unless we proceed by the method of elimination in this case, we will be obliged to do worse. Bolten proposed a genus much more homogeneous than most Linnaean genera, which was properly published. Nothing authorizes us to reject this genus; the name must be applied to part of its original content and retained."

In a book review of Dall's above paper, Burnett Smith (1907, pp. 129-130) disagreed in turn with Dall on the propriety of using *Plejona* Röding, saying: "*Volutilithes muricina* is evidently well removed from the forms usually described as *Volutilithes spinosus* and *Volutilithes petrosus*. The use of the generic name *Plejona* to designate such forms as the latter, seems, however, to be without warrant. As Mr. Newton had pointed out, Bolten refers his *Plejona fossilis* to four figures in d'Argenville. These four figures represent not only four different species, but four different genera!

"The very existence of the name *Plejona* rests, therefore, on a poor basis, and it is hard to see how its type, *P. fossilis*, can be restricted to *V. spinosa*."

Dall's reply (1907b), an open letter to Burnett answered Smith's argument as to the availability of *Plejona* as the proper vehicle for *V. spinosa*. Nevertheless Newton's *Volutospina* has been retained for this species by the great majority of workers.

The first post-Linnaean figures of *spinosa* are found in Chemnitz (1780-1795, vol. 11, pl. 212, figs. 3002-3003). These colored figures are comparable in excellence to the best modern ones. It is also figured in the

"Tableau encyclopédique" (pl. 392, figs. 5a, b). A good figure is found in Sowerby (1853, pl. 20, fig. 436).

A specimen of *V. spinosa* was found by Hanley, marked for *Strombus spinosus*, in the Linnaean collection in London, and the photograph on the microfilm of the collection entirely confirms the identification. It was not described in the "Museum Ulricae."

Strombus fissurella

1767, *Systema naturae*, ed. 12, p. 1212, no. 511.
LOCALITY: "In India Orientali" (1767).

"S. testa in labro continuato in carinam fissam longitudinalem . . . Testa magnitudine et statura Turbinis Clathri, alba: anfractus costis carinatis, excepto maximo, subtus laevi. Apertura oblongiuscula. Labrum exterius parum dilatatum; interiorius adnatum apertura: ex his labris excurrit per latus testae in carinam fissam longitudinalem, apice recurvatam supra testae verticem. Cauda brevis, recta, sinu parum distincta a labro."

The two references that Linnaeus added after the "habitat" ("Comes Stroganow." and "J. Falk, Profess. Petropol") could not be located, but Chemnitz (1780–1795, vol. 4, p. 338) explained them by saying, of the specimen seen by him: "it was obtained from Count Stroganow through the Petersburg Professor Falk." Thus it was merely a reference to the source of the specimen and not to any work.

The description, one of the most detailed and accurate in the "Systema," points clearly to the fossil shell that has always been known by the Linnaean specific name. Nothing in the description, however, suggests that it was a fossil, and this fact may have some bearing on the later confusion in the mind of Sowerby between *S. fissurella* Linné and *Strombus cancellatus* Lamarck, 1822, which is a Recent as well as a fossil species. Sowerby's treatment is discussed below. The synonymy, however, shows that Linnaeus knew that *fissurella* was a fossil. The Argenville figure (1742, pl. 33, line 2, no. 6) is on a plate headed "Coquillages fossiles," and he said in his text: "It comes from Comtagnion [*sic*]." The locality is probably a misprint for Courtagnon, a fossil locality in Champagne that is an extension of the Paris Basin (Eocene). The figures from Petiver (pl. 73, figs. 7–8) are not conclusive. Petiver said in his text (p. 7) that he had received "live shells of the

species from the East Indies." These were possibly specimens of Lamarck's *cancellatus*, a recent species from that region. Cossmann (1903, p. 166) reports the latter as occurring in the Pliocene of Karikal (India), and Cossmann's figures (pl. 6, figs. 14–15) are clearly *cancellatus*. However, Petiver also refers to his species as "A small Limington fossil whelk with narrowed sides," which is in line with other reports of the fossil occurrence of *cancellatus* in England. Petiver's mention of "live" shells may have been a printer's error for "like" shells. At least, I have seen no record of the Recent *cancellatus* from the Asian region, although I have specimens from the Sulu Archipelago.

Chemnitz (*loc. cit.*) refers *S. fissurella* Linné to the Courtagnon area, and said: "Linnaeus listed this shell without any hint that he was dealing with a fossil. . . . He only said that it came from Count Stroganow through the Petersburg Professor Falk," and added that it also occurred at Grignon in Champagne and in the East Indies. His figures (*tom. cit.*, pl. 158, figs. 1498–1499) are unmistakably *fissurella* Linné. Schröter (1783–1786, p. 144) lists the species and cites the Argenville figure and the reference to Chemnitz. He said: "What we know of this shell in the collections is that there are fossil examples from Courtagnon, but Linnaeus gives the East Indies as its home and seems to have seen it in its natural ["*natürlichen*" —?Recent] state." Röding (1798, p. 123) listed a *Tibia fissurella*, which he referred to Gmelin's *S. fissurella* and the Chemnitz figures. The description by Gmelin is a copy of that of Linnaeus.

Lamarck (1803, p. 221) moved *fissurella* to *Rostellaria*. In 1822 (vol. 7, p. 194) he cited for it both the Argenville and Petiver figures cited by Linnaeus, the Chemnitz figure, and a pair of excellent and unmistakable figures from the "Tableau encyclopédique" (pl. 411, figs. 3a, b). He correctly called it a fossil from Grignon and Courtagnon, but also quoted Linnaeus to the effect that it "lives in Indian waters." In the 1822 work he also described *Strombus cancellatus* (p. 212) which was later to be confused with *fissurella* Linné. He gave an equivocal description containing the phrase "Testa cancellata, alba; varicibus interruptis alternis," and in his French

description said, "It has the stromboid *sinus* . . . and . . . shows alternating varices." This description of the varices is not understood. The serious defect in the description, however, is his failure to mention the marked posterior prolongation of the columella and outer lip, which has been the cause of the confusion of the species with *fissurella*. The two species are distinguishable in three particulars: The fissured carina formed by the prolongation of the columella and outer lip reaches only to the penultimate whorl of the spire in *cancellatus*, whereas in *fissurella* it reaches to the vertex of the shell. Second, the cancellated sculpture of *cancellatus* is strong enough to have given the shell its specific name; in *fissurella* the spiral lines are so weak as to be scarcely visible without the aid of a lens. The figures cited by Lamarck for *cancellatus* from the "Tableau encyclopédique" (pl. 408, figs. 5a, b) are characteristic, except that they show a sinistral shell. Third, the lip of *fissurella* is more markedly dilate and rounded than the lip of the lanceolate aperture of *cancellatus*. Lamarck's allocation of *fissurella* to *Rostellaria* and *cancellatus* to *Strombus* is not understood. The short but sharp anterior canal of the fossil *fissurella* undoubtedly led him to place it in *Rostellaria*, but *cancellatus* also has a similarly shaped beak. It should be noted, however, that Lamarck described *cancellatus* as having the sinus of the strombs, although only slightly developed, and it is barely apparent in the "Tableau" figures. As a contrast to *cancellatus*, Lamarck's next species, *S. canalis*, another Grignon fossil, has a highly developed stromboid notch. This is shown in the figures of that species in the "Tableau" (pl. 409, figs. 4a, b), although not mentioned in Lamarck's description. Lamarck probably satisfactorily covered this point, however, in his sub-description, where he said: "The *Strombus spinosus* of Linné lacks the sinus of the strombs, and belongs with the volutes," thus contrasting *spinosus* with *canalis*.

Deshayes (*in* Deshayes and Milne-Edwards, 1835-1845, vol. 9, p. 662, footnote) took note of the confusion between the two species *fissurella* and *cancellatus*, saying: "Linnaeus said that his species was found in the waters of the East Indies. It is to be presumed that he was wrong, for this shell has never been

found except as a fossil in the Tertiary of the Paris Basin. Did not Linnaeus confuse with the fossil species a little living stromb (*Strombus cancellatus* Lamarck), which is very close to the fossil species?" Deshayes was correct in saying that *fissurella* is only found fossil, but he misread Linnaeus' diagnosis. The latter said only that the shell was found "in the East Indies."

Sowerby (1847-1887, vol. 1, p. 26, pl. 8, figs. 64-65) listed a *Strombus fissurella* which he referred to the twelfth edition of the "Systema" and to *Rostellaria fissurella* Lamarck, the latter reference with a query. His description might cover either *fissurella* or *S. cancellatus* Lamarck, except for the significant word "crenulated," as applied to the lip, which points to *cancellatus* exclusively. There is no doubt, however, about his figures, which are definitely *cancellatus*, showing a misunderstanding of the phrase "supra testae verticem" in Linnaeus' description of *fissurella*.

James Sowerby (1820, 1825-[1834], vol. 2) supplied a confusing treatment of this complex. He first (pl. 228, figs. 4-5) shows a good figure (fig. 4) of the shell, with the carina extending only to the second whorl of the spire, which he calls *Rostellaria fissurella*. It is a fair picture of *S. cancellatus*. In figure 5 on the same plate he shows a shell with the carina extending almost to the tip of the spire, and this he calls *R. labiosa*, a new name. On plate 231, under *Strombus*, his figure 7 is of a shell that he calls *Strombus fissurella* Linné. It has the shorter carina. His figure 8 on this plate shows an even shorter carina. This he names *S. decussatus* Defrance. He said in the text to the latter plate: "Fossil species are rare, and so far as we know, exist only in the newer formations above the Chalk; the London Clay at Barton furnishes one species; a third is found in the contemporaneous formation at Bordeaux, and two or three in the Tertiary Traps of Vicenza." I confess that I am unable to unravel the complexities of this treatment. The only certain thing is that Sowerby did not properly identify the Linnaean species.

In the "Mineral conchology of Great Britain" Sowerby had already described a fossil as *Rostellaria rimosa*, from England (1812-1829-[1846]), which seems to be *fis-*

surella Linné. If it is, it is the only synonym of that species.¹

G. B. Sowerby's misapprehension as to the identity of *fissurella* seems to be the only instance in which that shell was confused with *S. cancellatus* Lamarck, except in so far as James Sowerby's treatment may be interpreted as a similar mistake. The younger Sowerby was criticized by Deshayes (*tom. cit.*, p. 710, footnote) in his comments on *cancellatus*: "We do not share the opinion of Mr. Sowerby and some other conchologists^[2] who think that the *Strombus fissurella* of Linné is the same as the *Strombus cancellatus* of Lamarck. First, these shells are not in the same genus, and we think, with Lamarck, that the Linnaean species belongs to the genus *Rostellaria*. It is to be presumed that Linnaeus believed that the fossil so abundant in the Tertiary of Paris was to be found living. It is enough to read Linné's description carefully to be convinced that it applies solely to the fossil and not the living shell. The latter, consequently, should retain the name which Lamarck gave it. M. Kiener has figured *Strombus cancellatus* among the *Rostellaria*. This naturalist cannot have noticed the two sinuosities of the outer lip which characterize the genus *Strombus*."

Hanley (1855, p. 274) referred to the fact that, based on Linnaeus' locality ("in India Orientali") *fissurella* had been repeatedly classed among the Recent shells, and also noted that "an Indian *Strombus* (?)" was called *S. fissurella* in Sowerby's "Thesaurus." He also quoted Petiver, saying that the latter had received a "like shell (probably the *St. fissurella* of the 'Thesaurus') from the East Indies, but has delineated a Lymington example" (*italics mine*). He accepted Lamarck's

¹ The young shell of *Murex rimosus* Brander, 1766, has been compared, *vide* James Sowerby, with the British specimens of *fissurella*, but only because the form of the spire at that growth stage strongly resembles that of *fissurella*. The adult shell of *rimosus* is strikingly different from the young. Brander's shell is figured by Sowerby (*tom. cit.*, pl. 91, figs. 1-3).

² The present writer has not read any other author who has confused the two species. Certainly none of the important commentators have done so, although Tryon (1879-1888, vol. 7, p. 129) is confusing in this respect. He described *cancellatus* adequately, but in his Index to *Strombus* he entered it as "*Rimella cancellata* Lamarck, *non* Linné." As Linnaeus did not describe *cancellatus*, the entry is not understood.

fissurella as the *fissurella* of the "Systema," in which he was, of course, correct.

To summarize the results of the above investigation and to fix the species *fissurella* in its proper systematic position: *Strombus fissurella* Linné (*Rostellaria fissurella* Lamarck) was unquestionably based on an Eocene fossil from the Paris Basin, in spite of Linnaeus' locality, "in India Orientali." It is the type species of the genus *Rimella* Agassiz, 1840.³ The species is not found living and has not been reported fossil from the East Indies. *Rimella* appears to have died out in the Oligocene.

Strombus cancellatus Lamarck, which has been confused with the Linnaean species, is a living species from the Indo-Pacific region and has also been reported from the Pliocene of Indonesia and southeastern Asia. It has been assigned by many authors to the genus *Rimella* Agassiz or *Dientomochilus* Cossman, 1904, but belongs to neither of these genera, and has recently been placed, probably correctly, in *Varicospira* Eames, 1952, along with a small group of its congeners.

The name *Strombus fissurella* appears on Linnaeus' lists of species owned by him, and properly marked specimens are found in the Linnaean collection in London. The species was not described in the "Museum Ulricae."

Strombus urceus

1758, Systema naturae, ed. 10, p. 745, no. 440.

1767, Systema naturae, ed. 12, p. 1212, no. 512.

LOCALITY: "In O. Asiae" (1758, 1767).

"S. testa labro attenuato retuso brevi striato, ventre spiraque plicato-nodosis, apertura bilabiata inermi."

The following discussion of the above species is contributed by Dr. R. Tucker Abbott of the Academy of Natural Sciences of Philadelphia. Dr. Abbott has carried out the most recent and comprehensive investigation of the synonymy of this species and its various forms. I am in entire accord with his conclusions.

³ *Rimella* was erected by Agassiz in his contribution to the German edition of Sowerby's "Mineral conchology of Great Britain," which was not available to the present writer. It is so listed by Neave, who gives the date as "1841." Tryon (1879-1888, vol. 7, p. 129) and Thiele (1931, p. 252) state the date as "Agassiz, 1840." Tryon uses it as a subgenus of *Rostellaria* Lamarck.

"NOTES ON THE *Strombus urceus* COMPLEX

"The identity of Linnaeus' *urceus* presents several problems, but in view of what facts we have been able to gather it would seem wisest to associate the name with the *Strombus* illustrated in Reeve's *Conchologica Iconica*, 1850, vol. 6, pl. 11, figs. 24b and c, and Kiener's *Iconographie des Coquilles Vivantes*, 1843, pl. 15, fig. 2, pl. 30, fig. 2 and pl. 31 fig. 1b. These figures represent the *Strombus urceus* of most nineteenth century authors, and unquestionably are the same as shell 300 which is illustrated on the microfilm of the Linnaean types in the Museum Ludovicae Ulricaе (M.L.U. no. 288).

"Difficulty arises, however, over the fact that there are two closely resembling species in the Indo-Pacific. Linnaeus' description is not diagnostic enough, and his figure references are a mixture of the two species. Because of this, I think that the type specimen should be used as the determining factor. This is also in harmony with the *urceus* concepts of Lamarck, Deshayes, Sowerby, Reeve, Tryon, and others. Below is a brief diagnosis and synonymy for these two species:

"*Strombus urceus* Linnaeus

"Columella always smooth on the center region; aperture sometimes colored a dark, blackish brown; tip of siphonal canal in nearly every specimen is dark blue-black within and without.

"The geographical ranges of *urceus* and *labiatus* are about the same: Mauritius and Red Sea eastward to northern Australia and the Ryukyu Islands, and further east to Fiji, except that *urceus* is absent in Fiji.

"Non-binomial figures: Martini, *Conchyl.-Cab.*, vol. 3, fig. 803; Seba (1765), pl. 60, figs. 30, 31 (24?); Gualtieri (1742), pl. 32, fig. E; Knorr (1768), pt. 3, pl. 13, fig. 5. I have not seen Petiv. *Gaz.*, pl. 98, fig. 19.

"Synonymy:

- 1817, *Canarium ustulatum* Schumacher, *Essai Nouv. Syst.*, p. 219.
- 1828, *Strombus incisus* Wood, *Suppl. Index Testac. Cat. Shells*, pp. 14, 54, pl. 4, fig. 12.
- 1844, *Strombus anatellus* Duclos, in Chenu, *Conch. Illust.*, vol. 4, pl. 4, figs. 11 and 12.
- 1946, *Strombus ustulatus* form *laevis* Dodge, *American Museum Novitates*, no. 1314, pp. 2 and 3, figs. 1 and 5.

"*Strombus labiatus* Röding

"Columella always with fine spiral rugae or plications over its entire length; siphonal tip rarely, if ever, colored with dark blue-black. The shell usually differs from *urceus* in being proportionately higher-spined, more truncate basally, in having longer, more strongly developed and more numerous axial ribs, and, in some geographical areas, in having fairly strong, spiral threads on the body whorl. For excellent figures of this species see Duclos in Chenu's *Conch. Illust.*, pl. 5, figs. 1-7.

"Non-binomial figures: Martini, *Conchyl.-Cab.*, vol. 3, figs. 804, 806, 870; Seba (1765), pl. 61, figs. 25, 28, 29, 36, 37, 55; Runphius (1741), pl. 37, fig. T; probably Lister (1685), pl. 857, fig. 13.

"Synonymy:

- 1798, *Lambis labiata* Röding, *Museum Bolteni-anum*, p. 63, no. 806 (refers to Martini, *Conchyl.-Cab.*, vol. 3, pl. 78, figs. 804, 805).
- 1807, *Lambis reticulata* Link, *Beschreibung Naturalien-Sammlung*, vol. 2, p. 108 (refers to Martini, *Conchyl.-Cab.*, vol. 3, pl. 78, fig. 806).
- 1816, *Strombus plicatus* Lamarck, *Tableau Encyclopédique et Methodique*, and *Le Liste*, p. 3, pl. 408, figs. 2a, 2b (*non* Röding, 1798). Also 1822, *Anim. sans Vert.*, vol. 7, p. 210.
- 1828, *Strombus jugosus* Wood, *Suppl. Index Testac. Cat. Shells*, pp. 13, 54, pl. 4 (lower), fig. 4 (Indian Ocean).
- 1844, *Strombus olydius* Duclos, in Chenu, *Conch. Illust.*, vol. 4, pl. 5, fig. 7.
- 1946, *Strombus ustulatus* form *plicatus* (Lamarck) Dodge, *American Museum Novitates*, no. 1314, pp. 2 and 3, figs. 3 and 7."

R. TUCKER ABBOTT

Strombus dentatus

- 1758, *Systema naturae*, ed. 10, p. 745, no. o.
- 1767, *Systema naturae*, ed. 12, p. 1213, no. 513.

LOCALITY: Not given in either edition.

"S. testa labro attenuato brevi dentato, ventre spiraque plicatis."

The identity of this species has been mistaken by most writers, who have identified it with some form of *S. urceus* Linné. As late as 1885, Tryon (1879-1888, vol. 7, p. 118) said: "The difference between this species and *S. urceus* is so slight, and there is so much variation in the shells, that it is very doubtful whether their separation can be maintained."

How this came about is difficult to explain, as the descriptions of the two species differentiate them very clearly. In *urceus* Linnaeus described the lip of the shell as without teeth ("apertura bilabiata inermi"), the lip of *dentatus* is said to be toothed and short ("brevi dentato"). Two obviously distinct species were thus described, and the confusion between the two must have been due to inaccurate reading and comparison of the descriptions.

The species that Linnaeus so graphically described as *dentatus* is the shell later called *S. tridentatus* by Gmelin (1791, p. 3519), and the latter name has been used for it by the majority of conchologists, in spite of the fact that its true identity has been several times pointed out. Gmelin's error was in describing both *dentatus* and *tridentatus* as good species on the same page of his work, not realizing that he was giving two names to the same species. His *tridentatus* description is even more characteristic of the shell than of Linnaeus' *dentatus* which Gmelin copied for his *dentatus*. It is here quoted: "Str. *tenui alba aurantio maculata et nebulosa, dorso laevi plicato, cauda violacea, anfractibus canaliculatis, labro triacantho*" (italics mine). The only details omitted from this description are a mention of the plications of the spire and the fact that the outer lip is short. Gmelin added, however, a subdescription containing a phrase that might have led to the later confusion, as he said "*urceo affinis*." The species is easily distinguished from any form of *urceus*.

The species should be called by its first validly published name, *dentatus*, and Gmelin's *tridentatus* thrown into synonymy. It is unfortunate that the more highly descriptive name of Gmelin should be dropped, but this is a case in which a strict application of the Rule of Priority should prevail over any unwillingness to change an identification that has become current. It was not only an identification based on pure error, but on an error that has been pointed out by several writers and disregarded. In many museums and in all unrevised collections, *dentatus* Linné is still labeled *tridentatus*, and the name *dentatus* is given to one or another of the forms of *urceus*.

The confusion caused by Gmelin's double

listing of the same species and his statement that *tridentatus* was close to *urceus* did not appear for some time. Chemnitz (1780–1795, vol. 10, pp. 220–221, pl. 157, figs. 1501–1502) correctly read the Linnaean description of *dentatus*, calling the shell "*Strombus dentatus Linnaei*" and "*Die gezahnte Flügel-schnecke*," and copying the Linnaean description. He cited for it a group of figures from Seba (pl. 61, figs. 41–47), all of which show a shell with a toothed lip. Chemnitz' own figures are accurate representations of *dentatus* Linné, except that they were probably based on a subadult specimen, as the teeth are not fully developed, Chemnitz, however, introduced a complication by next listing a shell which he called *Strombus samar*. He gave no references, and his description makes no mention of teeth on the lip. His figure (*tom. cit.*, pl. 157, fig. 1503) is a dorsal view of a shell resembling *dentatus* but with only slightly developed teeth, as in his figures of *dentatus*, and showing marked gibbosity of the last whorl of the spire. The figures of the two species are so similar that the shells have been united in many collections, where many specimens of the typical *dentatus* are labeled *samar* Chemnitz. Chemnitz referred in his text covering *samar* (p. 221) to a group of figures from Martini (1769–1777, vol. 3, pp. 101–102, pl. 78, figs. 810–814), which the latter called "*Alata Samaar*," and referred to a long list of pre-Linnaean writers, but not to the "*Systema*." Two of these figures are apertural views, and all show a shell resembling *dentatus* Linné except in two details—the complete absence of teeth on the lip and the apparent obsolescence of all sculpture. The latter feature is also noticeable in the Chemnitz figure of *samar* (fig. 1503). It is now recognized that all the figures mentioned in the Martini-Chemnitz work are subject to criticism, but the best opinion is that *samar* Chemnitz is distinct from *dentatus* Linné. It is *Lambis fragilis* Röding, the earliest validly proposed name for the species, *Strombus samar* Dillwyn, 1817, and *S. bulbulus* Sowerby, 1842. The *S. samar* of Duclos, 1844 (1844–1845, vol. 7, pl. 4, figs. 13–14) is, however, clearly *dentatus* Linné, and Duclos' misconception of the species is partially accountable for the use of the name *samar* for *dentatus* in unrevised collections.

Born did not even list *dentatus*, and neither his description of *urceus* Linné nor the figures he cited for it carry any suggestion of the tridentate shell. Röding (1798, p. 62) described *dentatus* as *Lambis dentata*, citing for it *Strombus clavus* Gmelin (1791, p. 3510) and a pair of Chemnitz figures (1780–1795, vol. 10, pl. 157, figs. 1501–1502) above referred to. The latter reference is to *samar* Chemnitz, which means either that Röding believed that *samar* and *dentatus* Linné were identical or that the Chemnitz figures, whatever Chemnitz meant them for, adequately represented *dentatus*. The reference to *S. clavus* Gmelin was, however, a demonstrable error.¹

Dillwyn (1817, p. 674) described both *samar* Chemnitz and *dentatus* Linné as good species, but his references show that he was unwilling to unite *dentatus* and *tridentatus*. His *samar* is referred not only to the Chemnitz figure (fig. 1503) and the Martini figures of "Alata Samaar," but to *tridentatus* Gmelin, whereas his *dentatus* is referred to the *dentatus* of the "Systema" and of Gmelin and to Chemnitz' *dentatus* (figs. 1501–1502). Both are described as toothed, the description of *samar* reading "outer lip very little expanded and three-toothed," and that of *dentatus* "outer lip slightly expanded and toothed, and sinuated near the base," a distinction that shows a certain amount of confusion as to these two names. He added, as to *dentatus*, "it resembles *S. urceus*, but is said to be more obliquely plaited." This latter distinction is valueless, as *urceus* has both strongly plaited and almost smooth forms.

It should be noted that in none of the above descriptions of Gmelin, Martini, Chemnitz,

and Dillwyn is there any reference to the fact that the lip of *dentatus* is "brevis," as described by Linnaeus, as its lower portion curves sharply towards the canal in the section where the teeth are produced. This feature is not seen in any form of *urceus*.

Lamarck (1822, vol. 7, pp. 209–210) was also in error in his interpretation of this species. He first listed *Strombus tridentatus* (p. 209), citing for it both *S. samar* Chemnitz and *tridentatus* Gmelin, and included in his description the phrase "basi tridentato." In his French subdescription he reemphasizes this feature, saying: "The figures cited for this shell are more or less mediocre, with the exception of those of Seba who reproduces very well its general form and the three teeth on its outer lip [bord droit]." On the following page he lists *S. plicatus* (Lamarck, 1816), a new name, his Latin description using the words "labro parvo," but not mentioning the teeth on the lip. In his French description he specifically says, "Its outer lip is not toothed." The confusing feature of his treatment is the fact that he refers *plicatus* to *S. dentatus* Linné, using the locution "Lin. Gmel.," as was his custom, and citing the proper page of Gmelin. He thus disassociated the Linnaean species from any shell having a toothed lip. His treatment of *plicatus* strongly suggests that he was describing the deeply plicate form of *urceus*, except for his reference to *dentatus*. Incidentally, he had listed *urceus* Linné immediately before *plicatus* on the same page, describing it as the "subplicate" form of that species. He also referred *plicatus* to figures in the "Tableau encyclopédique" (pl. 408, fig. 2a, b) which are dorsal and ventral views of a deeply plicate sinistral shell with an unabbreviated edentate lip. It may have been intended for a plicate form of *urceus* but is too vaguely drawn to be identified with certainty. Lamarck had apparently not read, or had misread, the original descriptions of Linnaeus and Gmelin and was the first specifically to identify *dentatus* with a member of the *urceus* complex. Hanley (1855, p. 276) thus comments on Lamarck's error: "Lamarck erred doubly; he termed *plicatus* the very shell he had declared to be the *dentatus* of Linnaeus; and selected, as the representative of the Linnaean species, a *Strombus* that does not even exhibit the peculiar features from

¹ *Strombus clavus* Gmelin is the *S. clavus* Linné of the "Mantissa," as is shown by Gmelin's description, his reference to the "Mantissa" listing, and the figures he cited for it. This is an entirely different species belonging in the genus *Tibia* Röding. Röding's error seems to have been caused by the fact that, while Gmelin correctly cited for *clavus* a pair of figures from "Martini" (error for Chemnitz) (1780–1795, vol. 4, pl. 159, figs. 1501–1502), Röding, who properly cited two other figures for his *dentata* having the same numbers but shown in a different plate and volume (second series of plates), was apparently deceived by the duplication of the numbers and for some unexplained reason cited the species *clavus* Gmelin which was supported by the other pair of figures (vol. 4, pl. 159). It is idle to speculate how such an error could have been committed.

whence the specific appellation was derived."

It is unnecessary to comment on the treatment of this species by all the writers who have listed it. It is sufficient to say that Chemnitz and the editors of the "Neue Ausgabe" of the Martini-Chemnitz work, Sowerby (1847-1887, vol. 1, *Strombus*, p. 31), and Hanley (*loc. cit.*) either directly or by implication properly identified *dentatus* Linné with *tridentatus* Gmelin. A much larger number of writers, including Lamarck (*loc. cit.*), Deshayes and Milne-Edwards (1835-1945, vol. 9, p. 704, 706), Reeve (1843-1878, vol. 6, *Strombus*, pl. 9, sp. 17),¹ and Tryon (1879-1888, vol. 7, p. 118) continued the old error, either failing to recognize that *dentatus* and *tridentatus* were identical or calling *dentatus* a form of *urceus*. Hanley was the last who seems to have read the Linnaean description properly, and his comments are so emphatic that it is strange that they were overlooked. He said (*loc. cit.*) that *dentatus* "cannot well be mistaken, since of no other *Strombus* than one can the lip be declared toothed and peculiarly short. That shell, indeed, the *S. tridentatus* of Lamarck (*S. dentatus*, Sow. Thes. Conch., vol. 1, pl. 9, f. 86, 87) possesses all the required features, which, upon the whole, are so peculiar, that, if it had not been for the idea that 'labro attenuato' was equivalent to 'labri margine attenuato,' its identity would have probably suggested itself to all naturalists." Since Hanley's remarks I have found only one mention of *dentatus* that identifies it with the shell which was obviously described by Linnaeus under that name. This mention was by Dautzenberg and Bouge (1933, p. 295). In their listing of *S. dentatus* Linné they placed *S. tridentatus* "Lamarck" in synonymy. The name as used by Lamarck is demonstrably the same as that of Gmelin. They made, however, one error, as they also placed in the same synonymy *S. samar* Chemnitz and quoted Hanley as their authority, saying: "Hanley has demonstrated that the only *Strombus* to which the terms of the Linnaean description could apply is that which was called *tridentatus* by Lamarck,

and before that, *samar* by Chemnitz." Incidentally, Hanley did not mention *samar* in his comments on *dentatus*.

The most recent and exhaustive synonymy containing *dentatus* is that of *Strombus plicatus* Lamarck, 1816, by Adam and Leloup (1938b, pp. 112-116). That species is a synonym of the earlier *Lambis labiata* Röding, 1798, and has been confused with *S. urceus* Linné but is quite distinct. The species *dentatus* is called in this synonymy "*Strombus dentatus* Gmelin (*non* Linné)," which immediately raises the question of what Gmelin was describing. It is either identical with his *tridentatus*, and hence equals *dentatus* Linné, thus presenting a mere duplication of the species by Gmelin, or it is, in fact, *S. urceus* Linné or one of its forms. It is, I submit, impossible to tell whether Adam and Leloup were right or wrong. Gmelin's synonymy for *dentatus* contains several figures that I would be unwilling to ascribe to that species, and they are divided among four different varieties. On the other hand Gmelin, for his main description, copied Linnaeus' *dentatus* description verbatim, although in the sub-description he used the phrase "*urceo affinis*" and nowhere made any mention of a dentate lip, although the subdescription is long and covers all the other characters of both *dentatus* and *urceus*. I hesitate to pass on this extremely equivocal diagnosis. Adam and Leloup apparently adopt the view that Gmelin's *dentatus* was a member of the *urceus* complex, although their synonymy is a mixture of two good species, *urceus* Linné and *labiata* Röding.

Strombus dentatus Linné is figured by Reeve (1843-1878, vol. 6, *Strombus*, pl. 19, sp. 53a, b), but is called by the new name *S. samarensis*, and referred to *S. samar* Chemnitz, *tridentatus* Lamarck, and *dentatus* Sowerby, "not of Linnaeus." It is also well figured in Sowerby (1820, 1825-[1834], vol. 2, pl. 231, fig. 6) and by Kiener 1834-1850, vol. 4, *Strombus*, pl. 26, fig. 2). Both Sowerby and Kiener called the species *tridentatus*. All the above figures are excellent figures of *dentatus* Linné, as here interpreted.

Linnaeus apparently did not own a specimen of *dentatus*, as the name does not appear on either of his lists of owned species, and no specimen of it is found in the Linnaean

¹ Reeve referred *dentatus* Linné to *S. plicatus* Lamarck, and showed his confusion of mind by saying: "In the absence of a dentated lip, the compressed dorsal tubercles may probably have suggested the name by which Linnaeus distinguished this species."

collection in London. It was not described in the "Museum Ulricaë."

Strombus tuberculatus

1767, *Systema naturae*, ed. 12, p. 1213, no. 514.

LOCALITY: "In M. Mediterraneo" (1767).

"S. testa turrita ovato-oblonga tuberculata, labro incrassato . . . Testa ovato-oblonga, rudis, quasi calce obducta, anfractibus seriatis punctis corneis eminentibus. Labrum sutura quasi gibbum. Aperture ovata. Cauda brevissima, recurvata."

This species, which appeared first in the twelfth edition of the "Systema," was not supplied with any references and was considered by some writers, notably Hanley (see below), to be a *species dubia*. The description, while it contains certain details that apply to several other *Cerithium* species, certainly covers a *Cerithium*, and this is further suggested by a manuscript note in Linnaeus' copy of the twelfth edition to the effect that the species was to be transferred to *Murex*, where all his other *Cerithium* were included, in his revised twelfth edition.

The specific identity of the shell was not, however, immediately determined. Born (1780, p. 284, pl. 10, figs. 17-18) figured a shell which he called *Strombus tuberculatus* and referred to the *tuberculatus* of Linnaeus but which was certainly misidentified. Its spiral sculpture appears to consist of rows of large, black, longitudinally compressed, scale-like projections instead of the salient horn-colored nodules required by Linnaeus' description.

In the same year Chemnitz (1780-1795, vol. 4, p. 327, pl. 157, fig. 1490) described a "Turbo rostratus . . . fasciis nodosis nigricantibus seriatis dispositis." His figure is one of the worst in any of his plates and is almost unrecognizable, except that it somewhat resembles Born's figure, as it shows the "nodules" as flattened black scales. He cited the Born species as a reference and also a figure from Seba (pl. 55, fig. 21) which is much like his own. He abandoned the erroneous Mediterranean locality, placing the species in Chinese waters, and added: "Herr von Born considers this to be the *Strombus tuberculatus* of Linnaeus. Except for the fact that Linnaeus [in *Strombus*] associated many almost similar forms of *Buccinum* and *Murex*, I would not know how

or where he could make this a *Strombus*." He then specified several details in which his species differed from the requirements of Linnaeus' *tuberculatus* and concluded: "Can it then be *Strombus tuberculatus* Linné? My reader must decide."

Bruguière, in 1789 (1789-1792, vol. 1, pt. 1, p. 15, Index) erected the genus *Cerithium*, to which, in his later text (1792) he transferred those species in *Murex* Linné which he correctly concluded belonged in his new genus and also *tuberculatus* Linné, the latter under the name *C. morus* (p. 500).

In spite of the disavowal by Chemnitz of Born's *tuberculatus* as representing the Linnaean species, Gmelin, Dillwyn, and Lamarck all placed the Born reference in their synonymies of *tuberculatus* Linné. Gmelin (1791, p. 3421) copied the main description of Linnaeus and, with a few unimportant changes, the subdescription, and cited the inapplicable Seba figure cited by Chemnitz, the pair of Born figures, and the debatable figure by Chemnitz, and retained the erroneous Mediterranean locality. He also listed a *Murex sordidus* (p. 3561), for which he cited the same figure of Chemnitz, saying, "Is not this perhaps a variety of *Strombus tuberculatus*?" His description of *sordidus*, with the exception of the phrases "ut plurimum caerulecente" and "labro subalato," might conceivably be applied to the *C. tuberculatus* of modern authors, which I am identifying with Linnaeus' species. Dillwyn (1817, p. 675) not only cited the erroneous figure of Born, but listed Gmelin's *sordidus* as a synonym and continued to adopt the Mediterranean locality. His description is, however, characteristic. Lamarck (1822, vol. 7, p. 75) listed *C. tuberculatus* as of Linnaeus but still retained the Mediterranean locality and the erroneous Born and Chemnitz figures, as well as *C. morus* Bruguière. He added "The Red Sea" to the locality. His next species was *Cerithium morus* which he specifically disassociated from the *morus* of Bruguière, saying: "This deserves the name *morus* better than the preceding species, because it resembles it [a mulberry] and because its whorls are not coronate. Its granulate nodulations are numerous, close-set, and are placed on a reddish gray background, which is slightly violet." He gave no locality for his *morus*

but stated that a specimen was in his cabinet.

Both Lamarck's *morus* and *tuberculatus* Linné may be said to resemble a mulberry, although the likeness is more marked in the Lamarckian shell. The two species cannot, however, be confused. The nodules of *morus* Lamarck are very dark ("rubro-nigris"), whereas in *tuberculatus* they are light-colored ("corneis"). That word in the description in the "Systema" cannot be disregarded. Lamarck, in his description of *tuberculatus*, erred in calling them "nigerrimus." The *morus* of modern authors is the *morus* of Lamarck. It is a smaller shell than *tuberculatus* Linné (*morus* Bruguière), and its sculpture is quite different.¹

Sowerby (1847-1887, vol. 2, p. 289, pl. 182, fig. 175) was the first definitely to disassociate Born's *tuberculatus* from *tuberculatus* Linné, by renaming it *Cerithium bornii* and placing Born's name in its synonymy with the words "non Linné." His figure 175 is a characteristic picture of Born's shell. In the same monograph (p. 870, pl. 182, figs. 162, 164) Sowerby described and figured the Linnaean species and stated that his figure 162 was based on the original specimen in Lamarck's collection.

Reeve (1843-1878, vol. 15, *Cerithium*, pl. 4, sp. 21, 26) followed Sowerby in using the name *bornii* Sowerby for Born's *tuberculatus* and his figures are accurate (fig. 21 for *tuberculatus* and fig. 26 for *bornii*).

Tryon (1879-1888, vol. 9, p. 133, pl. 24, figs. 25-28), in listing *Cerithium tuberculatum*, emphasized the presence of a varix on the back of the body whorl as the feature that distinguished it from its allies, but did not refer to the sculpture except that it had "irregular, large tuberculated ribs and revolving rows of granules," a description that would refer to any of the granulated species of *Cerithium*. His figures are unsatisfactory, as, in the attempt to show the undoubted variation of sculpture in the species, some of them apparently show *morus* or *bornii*.

¹ In *tuberculatus* the tubercles are white or pale yellowish. There are two rows of large tubercles on the body whorl just below the suture and six to eight below, growing smaller anteriorly, usually two on the last whorl of the spire and three on the upper whorls. In *morus* the tubercles are slightly elongated laterally instead of round. The tubercles on both body whorl and spire are approximately of the same size throughout, and do not decrease in size anteriorly as in *tuberculatus*.

Except for *morus* Bruguière I know of only one synonym for the species, *Cerithium petrosus* Wood, 1828. It is not *Cerithiopsis tuberculata* Carpenter, 1857, nor *Cerithium vulgatum* var. *tuberculatum* Philippi, 1836, nor *Cerithium tuberculatum* Blainville, 1821 or 1826, nor *Strombus tuberculatus* Born, 1780.

There is no specimen marked for *tuberculatus* in the Linnaean collection in London. There is present an unmarked specimen of a shell which Hanley said (1855, p. 277) is "apparently the *C. moniliferum* of Kiener (Coq. Viv. Cer. pl. 16, f. 3), but, as the members of that crowded genus are by no means clearly defined, I have both figured the specimen and described it at large." He said that, of all the specimens in the collection, it alone answered to the description of *tuberculatus*, adding: "... but whether we should be justified in disturbing the modern name, since, without actual examination of the type itself, it was impossible to ascertain the species intended, is open to discussion." He then supplied an excellent description of *tuberculatum* of authors, but both his figure of the species in the collection² and the photograph of it in the microfilm of the same collection seem to show *morus* Lamarck. Hanley particularly referred to the "enamel-like glaze" of the specimen in the collection, noting that it conformed to the phrase "quasi calce obducta" in Linnaeus' description, but other nodulose *Cerithium* species show this glaze to a greater or less degree. In any event, the specimen in the collection has no authority as the type, as it is unmarked, we have no evidence that Linnaeus ever owned a specimen of the species, and it may have been added by another hand. Hanley went very far afield in referring to it as "the type itself."

I do not feel, as several other writers have, that this is a *species dubia* or that the identification of it with the *tuberculatum* of authors should be accepted with reserve. Linnaeus' description seems to limit the species to the latter name, if only by the significant phrase "punctis corneis," although I admit that many of the other details apply to several other nodulose *Cerithium* species.

It was not described in the "Museum Ulricae."

² Hanley (*op. cit.*, pl. 4, fig. 4).

Strombus palustris

1767, *Systema naturae*, ed. 12, p. 1213, no. 415 [error for 515].

LOCALITY: "In Indiae paludibus" (1767).

"S. testa turrita laeviuscula, labro postice [*sic*] soluto."

The identification of this species by the immediate followers of Linnaeus must have been based on the recognizable figures of the *palustris* of all authors in its synonymy. The figures from Rumphius (pl. 30, fig. Q) and Seba (pl. 50, figs. 13-14, 17-18), which comprised the entire synonymy, all show *palustris* with sufficient accuracy to define it. While the locality is also correct, the brief description is applicable to more than one species, although its scant details do apply to our *palustris*. The word "laeviuscula," however, is misleading as applied to a shell both the longitudinal and spiral sculpture of which is so well developed. It is certain that the frequent use of "laeve," "laeviuscula," and words of like import for even strongly sculptured shells was not due to error, but the words were purposely used in the sense of "shining" or "polished" in cases such as the present where, although the surface is irregular, the irregularities themselves, as well as the interspaces, show a glaze or polish. Chemnitz (1780-1795, vol. 4, p. 311, pl. 156, fig. 1472) emphasized this "smoothness" by calling the present species "Turbo palustris ceramicus" and spoke of its "schwarzbraunes glänzendes Farbenkleid," and Link (1807, p. 130) used the name *Cerithium ceramicus* for it.

As Chemnitz referred his "palustris ceramicus" to the *palustris* of the "Systema," Linnaeus' species was identified at least as early as 1780, and the name *palustris* has been constantly and universally used for the species, with the exception of two names, one of which was an instance of a second name for the same species in the same work. Gmelin (1791, p. 3521), after listing *palustris* with a much more ample and characteristic description, listed a *Strombus agnatus* (p. 3523) which was in all probability a duplicate name for *palustris* and has been often cited as a synonym. The Seba figure he cited for *agnatus* (pl. 50, fig. 19) is sufficiently characteristic to have been cited by Linnaeus for *palustris*.

The second name usually used for a synonym is *Cerithium crassum* Lamarck (1822, vol. 7, p. 71). This name appears in virtually every synonymy of *palustris*, although Lamarck's description departs from the description of the Linnaean species in several respects. Lamarck said of it: "It is related to the *cerithium palustre* but differs from it by its aperture which is very narrow, the right margin being much inverted." In Lamarck's Latin description of *crassum* the phrase "intus dentifero" is used. This is repugnant to any individual of *palustris* the present writer has seen. Lamarck also used the phrase "columella elongata, biplicata," a feature not visible in any perfect specimen of *palustris*. In that species the columella appears to bear merely a callous lump at its middle. However, when a sufficient part of the outer lip is broken away, there are revealed two clearly defined plications winding into the recesses of the aperture, the lower of the two being an extension of the callous lump seen in the perfect shell. It is not certain that Lamarck referred to this feature by his word "biplicata," as he does not say that the plications were visible from the outside. I feel, therefore, that the use of the word is repugnant to the view that *crassum* is a synonym of *palustris*. All the broken specimens seen by the present writer were young shells.

The species has been allotted to several different genera: *Cerithium* Bruguière, 1789, *Pyrazus* Montfort, 1810, *Potamides* Brongniart, 1810, *Terebralia* Swainson, 1840, and *Tympanotonus* Schumacher, 1817. The last is a name derived from Klein (pre-Linnaean), and most authors who adopted it used it as a subgenus of *Potamides*. Thiele (1931, p. 207) uses *palustris* in *Terebralia*, but speaks of it as *palustris* Bruguière. I can detect no difference between Linnaeus' and Bruguière's species and therefore, and, following what I believe to be the accepted opinion, I include the present species in *Terebralia* Swainson.

The best figure of *palustris* is that in Sowerby (1847-1887, vol. 2, *Cerithium*, pl. 185, fig. 261). It is also figured in Reeve (1843-1878, vol. 12, *Pyrazus*, pl. 1, sp. 2) and in Tryon (1879-1888, vol. 9, *Tympanotonus*, pl. 32, figs. 41-42).

The species is not found in the Linnaean

collection in London, and it was not described in the "Museum Ulricae."

Strombus ater

1758, *Systema naturae*, ed. 10, p. 746, no. 441.

1767, *Systema naturae*, ed. 12, p. 1213, no. 516.

LOCALITY: "In Asiae paludibus" (1758, 1767).

"S. testa turrita laevi, labro antice posticeque soluto."

The short description, which is identical in the tenth and twelfth edition of the "*Systema naturae*," when supported by the single excellent figure from Rumphius (pl. 30, fig. R) and a correct locality, is adequate to define the species. It was immediately identified by Linnaeus' successors.

Although Linnaeus called the shell "laevi," a term used, and correctly so, by most of the later writers, the lines of growth which are faintly seen through the dark brown epidermis may have been taken for a sculptural feature by some writers, notably Gmelin and Dillwyn, who described the species as transversely finely striate. These growth lines show an odd configuration. They begin as a series of short, close-set, vertical riblets just below the suture, but beyond the upper quarter of the whorl they turn abruptly to the left and continue as sinuous oblique lines. This obliquely directed growth is undoubtedly responsible for the sinuosity of the lip and the marked development of the posterior sinus.

The species is now included in the genus *Faunus* Montfort, 1810 (vol. 2, pp. 426-427), and is the type species of the genus, by original designation, as *Faunus melanopsis*.

As Linnaeus did not possess a specimen of the shell and as the name is not found on either of his lists of owned species, it is consequently absent from the Linnaean collection in London. The description of the species in the "Museum Ulricae" adds little to the diagnosis but does include the puzzling phrase "anfractus rotundati." The inapplicability of this phrase to the almost flat whorls of *ater*, which show only a barely measurable convexity, suggested to Hanley (1855, p. 278) that the "Museum Ulricae" shell might be some other species. He said, "Whether the *ater* of that publication should also be referred to the same shell may be doubted." The present writer is tempted to agree with

Hanley, as it seems inconceivable that Linnaeus should have used the phrase if he had had a specimen of *ater* before him. The phrase would apply to the *Helix fuscata* of Born (1780, p. 390, pl. 16, fig. 17), a shell also figured by Chemnitz (1780-1795, vol. 9, pt. 2, p. 164, pl. 135, fig. 1229) as *Helix ater*. This is another fluviatile shell much resembling *Faunus ater* (Linné), but its outer lip is entire, without the deep sinuses of *ater* Linné, although its whorls are appreciably rounded. The possibility that this is the *ater* of the "Museum" is, however, probably negated by the fact that Linnaeus began his diagnosis in that work with a repetition of the "*Systema*" description, with its graphic phrase "labro antice posticeque soluto," which is repugnant to the entire helicoid aperture of the Born shell. We cannot solve the problem, as there is today no specimen of either species in the Uppsala collection, and no specimen labeled *ater*. I am unable to suggest why Linnaeus used the disputed phrase.

Faunus ater had a complicated nomenclatorial history during the first century after Linnaeus. Otto F. Müller first described the adult shell under the name *Nerita atra* and the immature shell as *Nerita lineata* (1774, vol. 2, pp. 188-189). Schröter (1779, pp. 371, 372) adopted Müller's names for both the adult and juvenile shell. The adult is also Schröter's *Strombus atropurpureus* (p. 372). Chemnitz described and figured *ater* (1780-1795, vol. 9, p. 191, pl. 135, fig. 1227) under the Linnaean name, and his figure is characteristic. The association of this figure and that of Born's *Helix fuscata* on the same plate is illuminating in connection with the problem raised by the description of *ater* in the "Museum Ulricae." Gmelin (1791, p. 3521) repeated the Linnaean description, but introduced a new complication by also describing a *Strombus dealbatus* (p. 3523), a shell that many writers believe to be identical with *ater*, as its description uses the phrase "anfractibus transversis striatis nigris," which might refer to the growth lines that he described in *ater* as "subtilissime transversim striata." Moreover, he cited for *dealbatus*, as sole reference, the same Seba figure which he had already cited for *ater*. It is probable that these two listings represent merely a duplica-

tion of names for the same species. Gmelin's *Strombus lineatus* (p. 3521) was considered by Dillwyn (1817, p. 677) to be the young shell of *ater*, as Gmelin referred to Müller's *Nerita lineata*, and this identification is undoubtedly correct. Gmelin's *Buccinum acicula* (p. 3503) has also been united with *ater* by some conchologists, but while the main description of *acicula* is reasonably descriptive of *ater*, the phrase "testae apertura ovalis," with no mention of the deep sinuses of the lip, is not convincing.

The most recent identification of both Gmelin's *S. dealbatus* and *B. acicula* with *ater* Linné is by Adam and Leloup (1938a, p. 88). This identification may have been based on the mention of transverse sculpture in the descriptions of Gmelin's two species, which was probably used for the irregular growth lines, as these are more noticeable in the young shell than in the adult, although Adam and Leloup did not refer the two species to the young shell.

Bruguère (1789, 1792, pt. 2, p. 485) used the Linnaean name *ater*, but placed the species in his new genus *Cerithium*. It is curious that he (*op. cit.*, pt. 1, p. 328) placed the shell that Dillwyn and others believed to be the young *ater* in the genus *Bulimus*, as *B. terebralis*, using a specific name later adopted by Lamarck for the adult shell. Dillwyn (*loc. cit.*) referred to spiral striations on the whorls of the spire of *ater* but did not mention the oblique growth lines. I have not been able to detect such spiral lines on any specimen seen, and it is possible that, as some of his predecessors did, he meant by the phrase "finely striated transversely" the obliquely directed growth lines.

Following Montfort's *Faunus*, 1810, Lamarck (1822, vol. 6, pt. 2, p. 169) erected the genus *Pirena* for the reception of a group of fluviatile species, including *ater* Linné, under the new name *terebralis*.¹

¹ *Pirena* is a group in the family Melaniidae that Lamarck separated from both his *Melania*, 1799, and *Melanopsis* Férussac, 1807; from *Melania* because of the callosity of the columella in *Pirena*, which is almost, if not entirely, lacking in *Melania*, and from both genera because of the shape of the outer lip in *Pirena*. These are Lamarck's own distinctions, but one of them is inexact, as, at least in one of his own *Pirena* species (*P. granulosa*), the lip lacks both the posterior and anterior sinus.

Pirena was almost universally used by European conchologists for many years and is still employed today, the most recent use being by Mermod (1952, pp. 78–81), who also uses the Lamarckian specific name *terebralis*. It is probable, however, that he continued the use of the Lamarckian names for reasons of convenience and clarity, as, in the work mentioned, he was describing the original Lamarck types in the Geneva Museum. Beginning with the mid-nineteenth century, however, the name *Faunus* was increasingly used, especially by British and American authors.

Deshayes and Milne-Edwards (1835–1845, vol. 8, p. 499), although they listed the species *ater* under Lamarck's name, suggested in a footnote that *Pirena* be suppressed as unnecessary, and that *ater* be transferred to *Melanopsis* Férussac, with the restoration of the Linnaean specific name. The same suggestion was made as to the other *Pirena* species. I am not aware of any writer who has adopted the suggestion as to the change to *Melanopsis*.

Reeve (1843–1878, vol. 12, *Pirena*, pl. 1, sp. 5) described *ater* with a considerable synonymy including the Müller, Schröter, Gmelin, Bruguère, and Lamarck names mentioned above. He said: "In this form of *Pirena*, which we take to be the original type of the genus, the shell, composed of a greater number of whorls, is more elongately tapering than its congeners, and the sutures are less defined." The stouter form with the slightly convex whorls and less tapering and needle-like spire was listed separately as *Pirena picta* (sp. 3a, 3b), and Reeve wrote: "This species, hitherto confounded with *P. atra*, should, I think, be distinguished. It is of more swollen proportion, fewer whorls, void of ridged striae at the base, and exhibits a more decided variation of yellow painting." The present writer is not familiar with any form of *ater* having the characteristics noted for *ater* by Reeve. Moreover I suggest that *Pirena picta* is merely a specimen of the true *ater* with, possibly, slightly more convex whorls and that his figure of *atra* either represents the artist's conception of that shell or was based on a specimen of a form with which I am unfamiliar and which I have not since seen figured. I have not seen *picta* listed as a good

species except in an early paper by Brot (1862, p. 60). In a later work (1874, pp. 23–26) Brot omits any mention of *picta* and criticizes Reeve's figure of *atra*, saying that it is too subulate and slender, and that the true *atra* is more robust and more uniformly pyramidal. He continued: "It is the figure of Potiez and Michaud (Gal. pl. 31, fig. 8) with which it could best be compared." This latter figure (1828–1844), to which should be added figure 7 (the dorsal aspect), is satisfactory with the unimportant exception that the growth lines are not shown. In the article on the Melaniacea in the "Neue Ausgabe" of the "Conchylien-Cabinet" of Martini and Chemnitz (1874–[1879], p. 411) Brot is even more categorical as to the status of *picta*, as he puts it in the synonymy of *Faunus ater* Linné, as the "status juveniles" of that species. I entirely agree, except that neither of Reeve's figures of *picta* shows any indication, either in size or in the development of shell characters, that they were based on young shells.

In addition to the synonyms of *ater* mentioned above, see the following: *Ligula eburnum* Humphrey, "Museum Calonnianum," 1797; *Pirena acus* Lesson, 1830; *P. pagodus* Reeve, 1859, which Brot (1862) suggested was a monstrosity of *ater* with deeply channeled whorls; *Faunopsis princeps* (Lea) Gill (1863).¹ The "Pyrène de Madagascar" of Blainville, 1827, was treated by Deshayes and Milne-Edwards (*loc. cit.*) as a synonym. This species was not described by Blainville in the text volume of his "Manuel de malacologie" (1825, 1827), but a figure is found in his plate volume (pl. 21, figs. 2, 2a). The figures are called "Pyrène de Madagascar" on the legend to this plate and are clearly not *ater*, as they show an aperture with an entire margin.

Synonyms of *Faunus* Montfort, in addition to *Pirena* Lamarck, are *Eburna* Schumacher, 1817, *Melanomona* Bowdich, 1822, and *Faunopsis* Gill, 1863.

The best modern figure of *Faunus ater* is in Mermod (1952, p. 78, fig. 142), a photograph of Lamarck's type of *Pirena terebralis* in the Muséum d'Histoire Naturelle of Geneva.

¹ Brot (1862, p. 60) suggested that *princeps* was based on the young shell of *ater*.

A good pencil drawing of *ater* is found in Crouch (1827, pl. 15, fig. 15).

Linnaeus did not own a specimen of this species, as already pointed out. The description in the "Museum Ulricae" is discussed above.

Strombus lividus

1758, *Systema naturae*, ed. 10, p. 746, no. 442.

1767, *Systema naturae*, ed. 12, p. 1213, no. 517.

LOCALITY: Not given in either edition.

"S. testa turrita subangulata nodoso-spinosa, labro antice [*sic*] soluto."

The above description from the twelfth edition of the "Systema" differs from that in the tenth only by the addition of the word "subangulata."

This species has always been considered debatable, and I have seen nothing in the several attempts to identify it which leads me to a contrary view. No references or locality was supplied, and the description merely suggests, after the usual error as to the use of the word "antice" is corrected, one of the spinose turrids. It has been cited as *lividus* Linné by both Chemnitz and Humphrey, and identified by later writers, either categorically or tentatively, with either *Pleurotoma auriculifera* Lamarck or *P. echinata* Lamarck, 1822. These various suggestions are taken up chronologically below.

Linnaeus did not own a specimen of his *lividus*, and it seems possible from Chemnitz' discussion of the name in 1786 (1780–1795, vol. 9, pt. 2, p. 193, pl. 136, figs. 1269–1270) that Linnaeus, in 1758, must have merely seen the specimen so named in the collection of Spengler. It is probable, however, that he based his description, both in the "Systema" and in the "Museum Ulricae," on the specimen in the collection of Queen Louisa Ulrica, which was at that time at Drottningholm. While Chemnitz has been extensively quoted as having described the Linnaean species under the name *lividus*, it is apparent that the writers so quoting him had disregarded the doubts which Chemnitz himself had expressed. The latter said: "This shell is called *Strombus lividus* in the great Spengler collection. But I miss the rust-colored spots which Linnaeus so clearly noted in his description [in the 'Museum Ulricae,' 'maculis ferrugineis'] and, moreover, I do not

find the bluish, livid background (colorem lividum) which principally induced Linnaeus to call this *Strombus* by its specific name *lividus*. Finally, it seems to me that its shape is not so angular as Linnaeus himself seems to require in his characteristic diagnosis."

In the Portland Catalogue (1786, p. 91) we are referred to "A pair of large and fine *Strombus lividus* from Guinea." Iredale (1916, p. 92) relied on this mention as a valuable "early attempt to fix the Linnaean species." Iredale's comments are set out in full below.

Schröter (1783-1786, vol. 1, p. 449) admitted that he had not seen the shell, but quoted P. L. Müller as saying that its whorls are supplied with a row of cone-shaped, sharp spines, that the aperture is not contracted below, and that the lip is separated from the whorls at its posterior end by a sinus. Schröter comments: "Is all this true? I do not know."

Gmelin (1791, p. 3523) copied the Linnaean description from the "Systema" and fixed the species to his own satisfaction by citing the Chemnitz figures which Chemnitz himself had impugned as representing *lividus* Linné. These figures show apertural and dorsal views of the shell, which is somewhat higher than broad, with an aperture that recalls *Pleurotoma* except that the posterior sinus is not visible. The whorls of the spire are provided with a median band of large, blunt spines, and the body whorl bears a row of apparently hollow spines just below the suture which are decurrent in strong ribs almost to the base, where a row of large tubercles are seen on the dorsal face of the shell. The color is a dirty white, which may have been the artist's approximation of the word "lividus." The spine nearest to the outer lip is produced into an "ear." Chemnitz did not make it clear that he did not own the specimen on which the figures were based, and that it represented the artist's conception of the shell that he drew from Chemnitz' recollection of the Spengler specimen. The figures superficially resemble *Pleurotoma auriculifera* Lamarck (1816), as figured in the "Tableau encyclopédique" (pl. 439, figs. 10a, b) as *Clavatula auriculifera*.

Röding (1798) proposed two names, which, from the synonymy supplied, may be tentatively referred to *lividus* Linné. These are

Strombus canalicularis (p. 100) and *Turris St. Stephani* (p. 124).

With Dillwyn (1817, p. 678) we find a further query as to the identity of *lividus*. He paraphrased the Linnaean description in the "Systema," still with the erroneous detail "outer lip separated on the *anterior* side" (italics mine), and cited the references to Linnaeus, Chemnitz, and Gmelin. He also gave a very accurate paraphrase of the description in the "Museum Ulricae," which he translated as "turreted, subangulated, with smooth, pointed nodules, and a single row of straight conical acute spines in the middle of the whorls; color livid with ferruginous spots; aperture oblong, and not contracted at the base." He added, however: "Müller says that his *Buccinum torridum* differs only in not having any ferruginous spots, but Bruguière in his description of *Bulimus muricatus*, in the Encyclopédie Méthodique, p. 330, expresses a contrary opinion. Bruguière there alludes to a description of the Linnaean shell under the name of 'Cérithelivide,' but I cannot find any such species in his genus *Cerithium*." This illustrates the fact that Dillwyn realized that it was difficult to assign the Linnaean description to any one species and again brings to light Chemnitz' query as to whether the shell in the Spengler collection, which he saw and which Linnaeus apparently examined as well, was the same as the specimen described in the Queen's collection or the same that Chemnitz figured.

Lamarck (1822, vol. 7, p. 91) described *Pleurotoma auriculifera* in language that is not repugnant to the description in either the "Systema" or the "Museum Ulricae." He specifically referred his species to "*Strombus lividus* Lin. Gmel." and cited the Chemnitz figures of "*lividus*." On the same page he described *P. echinata*, a species with a markedly higher spire than *auriculifera*, lacking the projecting "ear" of that species and having flatter spines on its spire. Although no references were given except to the "Tableau" figure (pl. 439, fig. 8), the description may be said to fit that of *lividus* almost as well as that of *auriculifera*.

Deshayes and Milne-Edwards (1835-1845, vol. 9, p. 345) and Reeve (1843-1878, vol. 1, *Pleurotoma*, pl. 8, sp. 69) both identified

lividus with *P. auriculifera* Lamarck by placing it in the synonymy of the latter species. The first mentioned authors, in a footnote, were even more positive, saying: "Since Lamarck himself recognized the identity of his species with the *Strombus lividus* of Linné, one may rightfully ask why he changed the specific name, and since there can be no reason to justify this change, we must return to the species the name which it should never have lost and write it as *Pleurotoma livida*." It is a little difficult to understand how such a categorical identification could have been made on no stronger evidence than the fact that the characters of *auriculifera*, and particularly the "ear" formed by the largest spine, bore a resemblance to the Chemnitz figure, a figure, moreover, the antecedents of which were so suspect. It should not be forgotten that these authors had no evidence except the brief description in the "Systema" and the longer but no more instructive description in the "Museum Ulricae." They lacked references, locality, and type, and the most that may be gathered from the descriptions of Linnaeus is that the species was probably a *Pleurotoma*.

Hanley (1855, pp. 278-279) recognized the debatable nature of the evidence and would not definitely identify *lividus*. He mentioned the possibility that it was Lamarck's *auriculifera* and said: "Perhaps it is owing to the bad condition of ordinary examples of *Pleurotoma auriculifera* (the modern name of the Chemnitzian shell referred to) that I have never yet beheld a specimen that harmonized sufficiently with the following passages: 'Color lividus, maculis ferrigineis. Anfractus, in medio, serie simplici spinarum, conicarum rectarum, acutarum. Apertura basi non coarctata.'¹ Assuredly there are several known *Pleurotomae* which answer equally well to the published details, so that, although the *S. lividus* of Linnaeus may be cited (with a 'probably' attached) as a synonym of *auriculifera*, it seems hardly expedient to remove its very expressive name from the latter."

There is some discussion of *lividus* in the later literature, most of the commentators

having made identifications of the species with either *auriculifera* or *echinata* Lamarck.

Melvill (1917, p. 160) synonymized *Drillia* (*Tylotia*) *canalicularis* (Röding, 1798) with *Strombus lividus* Chemnitz and Gmelin, apparently being unwilling to refer it to the *lividus* as described by Linnaeus. He remarked: "Mr. C. Hedley uses Gmelin's name; but Iredale does not agree with this, and writes exhaustive reasons in favor of Bolten's name being employed."

The disagreement between Hedley and Iredale is here detailed:

Iredale (1916, p. 92) in a paper on the Solander species in the Portland Catalogue, said, under the heading "*Strombus lividus* Linnaeus": "Hedley, in the Proc. Linn. Soc. N.S.W., 1909, vol. 34, p. 453, used *Drillia livida* ex Gmelin explaining: 'In the absence of a figure and a type, the Linnaean *Strombus lividus* is, according to Hanley, unrecognizable. Under the circumstances it is better to adopt the name of Gmelin, securely based on the figure of Chemnitz (Conch. Cab. 9, pl. 136, figs. 1269-1270) than to use Lamarck's *auriculifera*.' I have made it a rule never to accept second-hand determinations, so that to me Linné's species being indeterminable, Gmelin's interpretation does not systematically concern me, save as a synonym. For the shell figured by Chemnitz, Bolten (prior to Lamarck) had proposed two names, viz., (Mus. Boltenianum, p. 100) *S[trombus] canalicularis*, and (p. 124) *T[urris] St. Stepheni*. I should therefore have preferred the safe method of nomination and called the shell '*Drillia*' *canalicularis* (Bolten). The sequel appears in the present publication [Portland Catalogue], as on p. 91 we read 'A pair of large and fine *Strombus lividus* from Guinea, Lister, 121, 17, rare.' Here we have a definite and earlier attempt to fix the Linnean species, and, moreover, one more valuable than Gmelin's, as Solander was a personal pupil of Linné and more likely to know the Linnaean shell. I cite this as of interest in confirming my proposed usage of the Boltenian species name, and *not* as an incentive to use Solander's acceptance of the Linnean name." The above is quoted in full, not only for its factual interest but because of Iredale's abortive attempt to create synonyms of an unidentifiable species.

¹ The foregoing phrases are from the description of *lividus* in the "Museum Ulricae," although the punctuation is somewhat altered.

Hedley in a later paper (1922, p. 254-255) makes a new identification of *lividus*. In his discussion of *Clavus* Montfort, 1810, he correctly gives its type species as *Clavus flammatus* Montfort, which is a type by original designation, and then says that *flammatus* "*= Strombus lividus* Linné *= Clavatula echinata* Lamarck." He justifies the identification of *lividus* with *echinata* as follows: "The specific identity of the genotype *Strombus lividus* was left in doubt by Hanley when he studied the Linnean collection, and it has not been decided since. I therefore wrote to Dr. Nils H. Odhner, of the National Museum of Sweden, inquiring if he could obtain any information on the subject. He kindly replied (21st. February, 1918) that he had in turn referred to Professor Wiren, in charge of the museum at Uppsala, where the Linnaean types are, who answered: 'A specimen labeled by Thunberg as *Strombus lividus*, Mus. Gust. Ad., is present here, and it may be considered with great probability to be the same as Linné described in the Mus. Ludovicae Ulricae, 1764.' This type specimen was submitted to Dr. Odhner, who described it as corresponding in shape, size and color to *Pleurotoma echinata* as figured by Reeve. The identifications of *Strombus lividus* by Chemnitz and Gmelin are thus shown to be erroneous."

Hedley's conclusion makes too great an assumption, as it does not take into account the present condition of the Queen's collection of shells at Uppsala and the present labeling of the specimens. In these papers I have several times stressed the fact that so many of the specimens are so inaccurately labeled that a reasonable doubt is cast on the reliability of the labeling as a whole. This matter is discussed in detail in my comments on the Uppsala collection and its catalogue, the "Museum Ulricae," in the Foreword to Part 1 (Dodge, 1952, pp. 16-18), to which the reader is referred. In brief, *Linnaeus himself did not label any of the specimens*. The first labels, which are with the shells today, were the printed slips prepared by Olaus Swartz,¹

¹ Lovén (1887, pp. 46-47), in his scholarly and exhaustive history of the "Museum Ulricae" and the Queen's collection, stated that all the original labels are the work of Swartz, and he does not mention labels written by Thunberg or by any other hand.

a botanist, who, in 1789, became the curator of both the Queen's collection and the collection of the King, the latter being referred to by Wiren as "Mus. Gust. Ad.," while the collections were still at Drottningholm, before their removal to Uppsala. Moreover, the transfer to Uppsala of this collection without authoritative labels opened the door to losses and mixture of species, and we find that during the past 150 years the collection has suffered further losses and misplacements of labels or specimens. This is strikingly shown by the critically annotated list in the hands of the present writer, which was prepared by Odhner in connection with the making of a microfilm of the collection that has been distributed to several museums in the United States. Certain of the labels are now placed with shells quite distinct from those indicated by the label, some shells are present that were not described in the "Museum Ulricae," and some of the specimens described are no longer present. The shell now labeled *Strombus lividus* is, however, a specimen of *Pleurotoma echinata* Lamarck, as Odhner correctly said. Even in the microfilm, where the picture of the specimen is somewhat dim, it could not be said to resemble *auriculifera* Lamarck.

On the above evidence I suggest that Hedley made too great an assumption when he categorically declared that the *lividus* of Linnaeus was the species later called *echinata* and based his conclusion squarely on the labeling of the specimen of *echinata* in the collection. I am not suggesting that the *lividus* of the "Museum Ulricae" and the "Systema" were the same species. That would be too great an assumption on my part. I believe that they were. However, there is little evidence of the identity of *lividus* outside this collection in Uppsala, and that is very weak. In my opinion we should not firmly identify a Linnaean species by using evidence as to which there is a doubt as cogent as that present here. The *lividus* of both works was undoubtedly a turrid, and the weight of evidence appears to the present writer to favor *auriculifera* Lamarck rather than *echinata* Lamarck. This is based on the possibility that the Chemnitz figure, which may be said to show *auriculifera*, truly represented Linnaeus' shell, as having been based on the Spengler specimen which I be-

lieve Linnaeus saw and possibly used as his model.

As Hanley said, the case is too doubtful to tie *lividus* to any one species, and I therefore am content to treat it as a *species dubia*.

The most recent identification is that of Grant and Gale (1931, p. 574) who identify *lividus* with *auriculifera* Lamarck. In listing *Clavus* Montfort, 1810, as a good genus they give *Tylotia* Melvill, 1817, as one of its synonyms, with type species *Strombus canalicularis* Röding, 1798, + *Pleurotoma auriculifera* Lamarck, 1822, by original designation, and add: "+*Strombus lividus* Linnaeus," citing for the latter the Chemnitz figure, Gmelin's listing of the name, and "*Drillia livida* Linnaeus" of Hedley, 1909. For *Clavus* Montfort they give as type species *Clavus flammatus* Montfort + *Clavatula echinata* Lamarck, and add: "= *Strombus lividus* Linnaeus . . . *fide* Hedley . . . 1922, cf. also Iredale . . . 1916." It is to be noted that the identification of *lividus* with *echinata* Lamarck, as the type species of *Clavus*, is only stated to be "*fide* Hedley," while the identification with *auriculifera* Lamarck, as the type species of *Tylotia*, seems to be their own conclusion.

THE "MANTISSA" SPECIES IN *Strombus* LINNÉ

Strombus minimus

1771, Mantissa plantarum . . . regni animalis appendix, p. 549.

LOCALITY: "In India orientali" (1771).

"Testae labro retuso gibbo, ventre spiraque plicato-nodoso, apertura bilabiata laevi . . . Testa simillima *S. urceo*, sed minor. Dorsum testaceum. Faux laevis, flava, nec striata. Labium utrumque albidum."

Most of the descriptions of the species of mollusks in the "Mantissa" are less satisfactory than those in the "Systema," probably because Linnaeus did not own specimens of most of the shells. *Strombus minimus* is one of the exceptions to this rule. Its diagnosis, except for two misleading details, is entirely adequate to define the species and to distinguish it from any of its congeners in *Strombus* Linné. The phrase "Apertura bilabiata" is expressive of the extreme callosity of both the columella and outer lip, as it makes the shell seem to have two well-

defined and calloused lips. The word "bilabiata" is, however, a word little employed by Linnaeus and in *Strombus* is used only for this species and *urceus*. It is not a technically correct use to call the columella or the edge of the parietal wall a "lip," and the word might confuse a modern reader, as in some species in other genera the outer lip is itself doubled. Moreover the words "laevi," as applied to the aperture, and "Faux laevis, nec striata" are erroneous. The aperture of *minima* shows ridges, although these are faint even in fresh specimens and occupy only the lower third of the aperture just inside the lip. It was probably the callosity around the aperture that led Linnaeus to compare the shell to *S. urceus*, although it almost equally resembles *epidromis* except in size. The largest specimen seen by the present writer had a height of only 1½ inches, the average height being approximately 1 inch. The phrase "ventre spiraque" is an attempt to say too much in too few words. The spire is, it is true, strongly plicately nodose, but the body whorl is smooth except for one or two well-developed nodes or spines at the shoulder, the remaining nodes being obsolete or obsolescent, those nearest to the parietal area being decurrent into low plications for a short distance below the shoulder.

The single figure in the synonymy (Rumphius, pl. 36, fig. P), which Rumphius called "*Epidromis minima*," is adequately characteristic.

In 1788 Chemnitz (1780-1795, vol. 10, p. 214, pl. 156, figs. 1491-1492) published very accurate figures of the species, showing both dorsal and apertural aspects, which compare favorably with the more recent figures. He referred the shell to the *minimus* of the "Mantissa." Gmelin's *minimus* was demonstrably the same as that of Linnaeus, as appears from his somewhat more graphic description (1791, p. 3516) and his references to the Rumphius and Chemnitz figures. He, however, fell into the same error as Linnaeus by describing the aperture as "nec striata." Dillwyn (1817, p. 670) improved the description by referring to the well-developed stromboid notch of the species and the similar sinus at the posterior end of the lip, as well as the slight reflexion of the lip.

Lamarck (1822, vol. 7, p. 209) dropped the

name *minimus* for no apparent reason and substituted *trogloodytes*, although he referred his species to the *minimus* of Gmelin and the appropriate figures. This change of name was criticized by Deshayes and Milne-Edwards (1835–1845, vol. 9, p. 703) in a footnote to *Strombus troglodytes*: "Named *Strombus minimus* by Linné, in his *Mantissa*, this species should resume the original name in the place of *trogloodytes* wrongfully given to it by Lamarck."¹ The Lamarckian name has been occasionally used since their day, although usually only in synonymy.

The Linnaean collection in London does not contain a specimen of *S. minimus*, as the species was undoubtedly described from a specimen not owned by Linnaeus. It was not described in the "Museum Ulricae."

Most of the later figures, after Chemnitz, fail to show with any clarity many of the diagnostic features of the species. It is fairly well figured by Sowerby (1847–1887, vol. 1, *Strombus*, pl. 6, figs. 4–5), by Reeve (1843–1878, vol. 6, *Strombus*, pl. 18, sp. 47), and by Tryon (1879–1888, vol. 7, *Strombus*, pl. 6, fig. 62).

The scant references to this species in recent literature may be due to its comparatively restricted range, although it is common within this range. Of the considerable series seen by the present writer, all specimens were from the Philippines, the Solomon Islands, the Fiji Islands, and Papua.

Strombus clavus

1771, *Mantissa plantarum . . . regni animalis* appendix, p. 549.

LOCALITY: Not given.

"Testa turrita laevi, cauda subulata, labro simplici . . . Testa turrita, digito brevior, glabra, anfractus circa 13, quorum duo infimi laeves; reliqui longitudinaliter striati, sed anfractus infimus subtus transversim striatus. Cauda filiformis s subulata, rectissima, glabra, 1/3 totius. Apertura ovata, laevis."

The description of this species makes it reasonably clear that Linnaeus was describing

a member of the genus *Tibia* Röding, 1798. It is also certain that the description covers an immature shell, although in a fairly well-advanced stage. This is indicated by the fact that it had already acquired teeth on the outer lip ("digito brevior") and that the length of the anterior canal was already considerable (" $\frac{1}{3}$ totius"). The latter phrase, indeed, makes it clear that the specimen was an almost adult shell of *Tibia rectirostris*² (Lamarck), 1822, although, in the last analysis, there is little in the diagnosis that indicates that the shell was not a completely mature specimen, except for the single figure cited (Argenville, 1742, pl. 13, fig. A) which shows a young *Tibia*. Linnaeus did not own a specimen of *clavus*, as is the case with most of the "Mantissa" species, and it is believed that he relied on the shells in the collections of either Ziergovell or De Geer in Sweden (see Hanley, 1855, p. 453). In as much as his description was probably written and his synonymy chosen without a model before him, we can more easily forgive the lack of harmony between the description and the Argenville figure, the beak of which is much shorter than " $\frac{1}{3}$ the height of the shell."

Chemnitz (1780–1795, vol. 4, p. 342, pl. 159, figs. 1501–1502) listed *Strombus clavus* as of the "Mantissa" and referred also to the young shell of *Strombus fusus* of the "Systema." As said above under *Strombus fusus* (p. 241) Chemnitz cited the twelfth edition for both the long-beaked shell (*rectirostris*) and the short-beaked shell (*curvirostris*), so that the Chemnitz treatment is of little assistance in the allocation of *clavus* to one shell or the other.

Gmelin (1791, p. 3510) referred, for *clavus*, to the Argenville figure cited by Linnaeus and the Chemnitz figures of an immature *Tibia* species. His description, however, is very short: "Str. testa territa [*sic*] laevi: cauda subulata, labro simplici," and is not sufficiently elaborated to point to the young of either *rectirostris* or *curvirostris*. Röding (1798, p. 123) included *clavus* in his *Tibia*,

¹ It is interesting to note that these authors never hesitated to criticize Lamarck for his unnecessary changes of specific names, which may have reflected a purely chauvinistic attitude. They apparently did not share the unreasoning veneration with which Lamarck's nomenclature has so often been treated by other writers.

² The present writer notes above, in the discussion of *Strombus fusus* (pp. 238–244) that the great preponderance of evidence shows that *fusus* Linné, although its description and synonymy fell short of complete clarity, was the species later called *Rostellaria curvirostris* Lamarck.

calling it "Die ungezahnnte Stern-Nadel," which again is merely the description of a young shell.

Dillwyn (1817, p. 655) did not include *clavus* in the synonymy of *Strombus fusus*, even as the "junior" form, but placed it correctly, as I believe, in the synonymy of *unicornis*, his new name for the long-beaked shell, as the "junior" stage of that species. This is the first attribution of *clavus* to the long-beaked shell.

Lamarck (1822, vol. 7, p. 192) gave specific names to both the forms, and his descriptions of *curvirostris* and *rectirostris* graphically define the two species. It was *curvirostris* to which he referred the Linnaean *fuscus*, as did Dillwyn, but, as did Dillwyn also, cited *clavus* as the young shell of the long-beaked species *rectirostris* (*unicornis* Dillwyn).¹

Both Deshayes and Milne-Edwards (1835-1845, vol. 9, p. 655) and Reeve (1843-1878, vol. 6, *Strombus*, pl. 2, sp. 5) placed *clavus* in the synonymy of *rectirostris* Lamarck, although the latter writer referred to *clavus* as "*S. clavus* Gmelin." Tryon (1879-1888, vol. 7,

¹ I suggest under *Strombus fusus* (p. 239, above) that the beak of Lamarck's *curvirostris* sometimes belies its name, as it is often not curved. It is sometimes straight, in the axis of the shell, and sometimes bent obliquely to the right.

p. 128) resumed the use of the Linnaean name *fuscus*, as *Rostellaria fusus*, and placed "*clavus* Gmelin" in its synonymy along with all the synonyms of the long-beaked shell, *R. rectirostris* Lamarck, *R. subulata* Schumacher, 1817, and *Strombus unicornis* Dillwyn, 1817. Sowerby did not mention *clavus*, under any authorship, in the "Thesaurus Conchyliorum," nor did Kiener.

I see no reason for the action of some authors in referring *clavus* to Gmelin rather than to Linnaeus, except for their preoccupation with Linnaeus' discordant synonymy of *fuscus*. Their choice seems to have been based on timidity rather than on conviction. Viewed realistically, however, Gmelin's synonymy of *clavus* is just as confusing as the synonymy of *fuscus* in the "Systema" or of *clavus* in the "Mantissa." He cited only the Argenville figure (pl. 10, fig. A) and the Chemnitz figures (vol. 4, pl. 159, figs. 1501-1502), both of which may be said to represent the young shell of either the short-beaked or the long-beaked species. On all counts, therefore, we may say that the consensus is that *clavus* Linné was in fact a young long-beaked *rectirostris* (*unicornis* Dillwyn).

There is no specimen of *clavus* in the Linnaean collection in London, and the species was not described in the "Museum Ulricae."

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CORRECTIONS FOR PART 3 (DODGE, 1955)

Page 48, column 2, line 36: For "Is" read "It."

Page 59, column 1, line 10: For "*tonratilis*" read "*tornatilis*."

Page 69, column 2, line 29: For "*Ispidula*" read "the *ispidula* of authors."

Page 71, column 1, line 14 from bottom: For "the

other two Linnaean Olives" read "two other Olives."

Page 71, column 1, line 13 from bottom: For "*ispidula*" read "the *ispidula* of authors."

Page 150, column 2, line 18: For "1853" read "1753."

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